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**PROCEEDINGS OF THE SYMPOSIUM ON THE LIVING RESOURCES
OF THE AFRICAN ATLANTIC CONTINENTAL SHELF
BETWEEN THE STRAITS OF GIBRALTAR AND CAPE VERDE**

Organized by the International Council for the Exploration of the Sea (ICES)
with the support of the Food and Agriculture Organization of the United Nations (FAO)

Santa Cruz de Tenerife, 25-28 March 1968



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 1969

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25 - 28 March 1968

REPORT AND ABSTRACTS OF PAPERS

Prepared
by

Marine Biology and Environment Branch
Fishery Resources and Exploitation Division
FAO, Rome

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, September 1969

PREPARATION OF THIS REPORT

The publication is part of the Proceedings of the Symposium on the Living Resources of the African Atlantic Continental Shelf between the Straits of Gibraltar and Cape Verde, organized by ICES with the support of FAO, and held in Santa Cruz de Tenerife on 25-28 March 1968. The present volume, issued by FAO, containing the general report and abstracts of papers presented at the Symposium was prepared and edited by the Marine Biology and Environment Branch, Department of Fisheries, Rome. The full text of the contributed papers selected to be printed will be published by ICES in due course, in Rapports et Procès-Verbaux des Reunions volume 159.

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I. GENERAL REPORT

1. INTRODUCTION

During the 52nd Statutory Meeting of the International Council for the Exploration of the Sea in 1964, at the request of the chairmen of the Atlantic Committee, the Scombriform Fish Committee and the Sardine Committee, it was decided to hold a symposium on oceanographic and fishery problems in the African Atlantic north of the Equator (Resolution 1964/7).

At the Statutory Meeting of 1965, the Steering Committee, established to study the progress of the project, underlined the need for an early convening of this Symposium in view of the rapid development of fisheries in the tropical zone of Africa and signs of over-exploitation of some stocks of fish and crustaceans in this zone. However, in order to specify and delimit the objectives of the Symposium, it was decided to deal only with the resources of the African continental shelf, their stocks and fisheries, between the Straits of Gibraltar and Cape Verde.

It was on this basis that the Symposium was prepared and organized. The Bureau of the Council in 1967 named Mr. R. Letaconnoux, Chairman of the Southern Pelagic Fish Committee, Convener of the meeting, and appointed Mr. H. Tambs-Lyche, ICES Secretary-General, and Dr. M. Ruivo, Acting Director of the FAO Fishery Resources and Exploitation Division, to be joint secretaries.

The meeting was held at Laguna University in Santa Cruz de Tenerife from 25 to 28 March 1968, with 90 participants belonging to 18 countries or representing UNESCO, FAO and ICES.

As a result of efficient organization by the Spanish authorities and the considerable number of participants, the debate was particularly interesting and fruitful, and it attained the main objectives assigned to the Symposium. The Symposium provided an opportunity to review the various aspects of fishery research in this part of the Atlantic, to give a summary of available knowledge and to examine the hydrographic, biological and statistical work that has to be undertaken. This was possible as a result of the considerable number and quality of contributions submitted to the Symposium and also thanks to the competence of the chairmen of the various scientific sections and the considerable bibliographic and analytical work accomplished by them to present syntheses which, when published together with the Symposium contributions, will form a good source of information.

2. OPENING SESSION

The Rector of the University of La Laguna, Don Antonio Gonzales, welcomed the participants of the Symposium to the University and introduced H.E. Don Faustino García, the Minister of Commerce.

The Minister, in his opening address, welcomed the participants on behalf of the Government and the people of Spain. He referred to the great importance of the fisheries off north-western Africa carried out by many nations, both those bordering the African continental shelf and those from farther afield, and he stressed the need for further, more intensified studies of the living resources in the area and of the influence of the environment on them. The Minister complimented the International Council for the Exploration of the Sea and FAO for having organized such a Symposium, thereby providing an excellent opportunity for specialists to meet and to review the state of knowledge of the oceanographic conditions and living resources in this area and to develop programmes for further research in order to fill the existing gaps.

The Minister then declared open the Symposium.

Dr. A.E.J. Went, the President of ICES who was in the chair during the Opening Session, expressed thanks to the participants, the Council, the University of La Laguna and to the Spanish Government^{1/}.

An address was also made by Dr. M. Ruivo on behalf of the Director-General and the Department of Fisheries of FAO^{2/}.

3. OFFICERS AND ORGANIZATION OF WORK

Dr. A.E.J. Went, President of the International Council for the Exploration of the Sea, presided over the Symposium.

Mr. R. Letaconnoux acted as the Convener, and Mr. H. Tambs-Lyche and Dr. M. Ruivo were in charge of the Scientific Secretariat.

The Symposium was held in seven scientific sections, each headed by a qualified expert who had to present a general review on the available knowledge in the specific field and to summarize the contributions submitted and the discussions on them.

The following scientists acted as Chairmen and Rapporteurs of the Sections:

	<u>Chairmen</u>	<u>Rapporteurs</u>
1. General faunistics	Dr. Cl. Maurin	Dr. J. Bladre
2. Physical oceanography:	Dr. Ch. Allain	Prof. N. Menendez
3. Plankton:	Prof. M.L. Furnestin	Dr. T.S. Neto
4. Crustaceans and molluscs:	Dr. H.Z. Vilela	Dr. R. Monteiro
5. Fish:	Dr. F. Lozano	Dr. J. Dardignac
6. Statistics and Stock Assessment:	Mr. J.A. Gulland	Mr. L.P.D. Gertenbach
7. Fisheries and utilization of catches:	Prof. A. von Brandt	Dr. B. Diop

All meetings of the Symposium were held as plenary sessions. At the final session, the Convener summarized the work of the Symposium and outlined its general conclusions.

The present report contains only a summary of the contributions referred to in the reports of the sections. Most of them are to be published in a special volume of the "Rapports et Procès Verbaux" of the International Council for the Exploration of the Sea (No. 159).

4. GENERAL CONCLUSIONS

R. Letaconnoux, Convener

Following the Symposium held at Abidjan in October 1966 under the auspices of UNESCO, FAO and OAU to study the fisheries resources of the tropical Atlantic, and the FAO Technical Conference on Fisheries of West African Countries held at Dakar in August 1967, the Symposium on the Living Resources of the African Atlantic Continental Shelf between the Straits of Gibraltar and Cape Verde, organized by the International Council for the Exploration of the Sea (ICES), with the support of FAO, has led to the forging of a useful link between the work of the Council and the research being conducted in all countries of the African Atlantic Coast.

^{1/} see Annex 2

^{2/} see Annex 3

The holding of the Symposium shows the growing interest in these matters in a region of particular importance for its abundant resources. It is gratifying to note that the papers submitted and the discussions that took place during the Tenerife Symposium now make it possible to identify some of the most noteworthy features of this area and to stress certain problems faced in fishery development. It is also possible to discern the general outline of future research work that must be undertaken in order to lay the foundations for rational exploitation of the marine resources of this part of the western Atlantic.

General research problems

The region of the Atlantic between Gibraltar and Cape Verde does not constitute as clearly defined a biogeographic unit as is commonly supposed. The collation of data on physical oceanography, plankton and general faunistics provide evidence on which to distinguish three coastal zones, which may be named as follows:

- (a) Ibero-Moroccan (Gibraltar to Cape Juby)
- (b) Saharan (Cape Juby to Cape Blanc)
- (c) Senegalese (south of Cape Blanc)

Even within a more general framework, Cape Blanc is the dividing point between the two major faunistic provinces - Atlanto-Mediterranean, to the north, and Tropico-African, to the south.

The zones so defined can in no sense be absolutely rigid, since allowance must be made both for seasonal or bathymetric variations observable in the distribution of species over the continental shelf and along the slope and for the peculiar character of the Canary fauna, with its West Indies affinities, though exhibiting characteristics common with the fauna encountered more to the south, at a depth of 500 m off Cape Bojador.

Nevertheless, the three zones defined above may serve as geographic frameworks for a fair range of bioecological studies or for carving out statistical areas.

The particular importance of Cape Blanc in Mauritania has also been noted by physical oceanographers, since this is where the central north Atlantic waters come into contact with the equatorial waters. While information is lacking on the machinery and seasonal regime of the highly important upwelling phenomena, particularly off Morocco and Río de Oro, their influence on abundance of fish in given areas cannot be disregarded. Such phenomena explain the remarkable primary productivity of the Cape Blanc region and the abundance of the plankton biomass off the African coast. For this reason they constitute one of the essential elements in a general study of the region.

Physico-chemical research on the waters over the continental "fringe", on the conditions governing upwelling and on ocean current regime nevertheless needs to be further developed, together with the studies on ichthyoplankton, indicator species and on correlation between abundance in nutrient salts, plankton and fish.

But it will also be necessary to coordinate these surveys and studies, on the one hand with a view to a better understanding of the productivity of this region at the various levels - and, on the other hand, in order that the findings may serve as a general basis for fisheries studies off the coast of north-west Africa.

Problems encountered in fishery studies

Although the fishing grounds of the Saharan coast have been worked for very many years, rather little indeed has been achieved in the way of detailed surveys. There is only little or fragmentary information on the biology and ecology of species caught,

and none at all on volume or composition of catches. Similarly lacking are data on developments in terms of fishing effort in this part of the Atlantic, which is known to be progressively more frequented by large fleets from Europe and from Asia, to engage in fishing for crustaceans, molluscs and fish.

(a) Catches

In the case of crustacea, whether it be "crevettes" (shrimps and prawns) off Morocco or "langoustes" (spiny lobsters) south of Cape Blanc, the resources known so far are certainly overfished, even though the inventory of the latter is apparently not yet complete. Such a conclusion has been warranted ever since 1962 by developments in Penaeus duorarum fisheries along the coast between Saint Louis and the Cayar trough. Parapenaeus longirostris, off Mauritania, should be a worthwhile subject of research in the ocean canyons cutting across the shelf between Timiris and Cape Verde. The same may perhaps be said of Palinurus vulgaris, which has been reported at 500 m depth around the Canary Islands.

Molluscs apparently are not fished in any organized fashion despite the abundance of mussels on some of the rocky parts of the shelf and the potentialities for Crassostrea angulata culture along the Moroccan coast.

Cephalopods, on the other hand, are abundant, the bulk of the catches consisting of Sepia officinalis hierredda and, to a secondary degree, of Loligo vulgaris and Octopus vulgaris.

Yet, the main activity over the north-west African continental shelf is the catch of fish, which is oriented towards three different types of fishery.

In the first place, there are the Clupeidae, pilchard (Clupea pilchardus), sardines (Sardinella species) and "ethmalose" (Ethmalosa fimbriata) off Senegal, fished chiefly by means of surrounding nets. These species should be surveyed in order to sound out information on their biology, their stock abundance and the distribution and ecology of their component populations.

Various species of the Carangidae and Scombridae (mackerels) which have been fished for only a few years as yet are capable of yielding large catches, often by industrialized fleets using midwater trawls. Landings seem to maintain a satisfactory level.

Finally, traditional methods of working bottom fish are employed by a wide range of craft. Catch per unit effort has declined markedly over the last few years - since 1962, if one is to judge from Portuguese statistics. The decline in landings is most noteworthy in the case of hake and perhaps also of the Sparidae. These, together with the Serranidae, the Lutjanidae, Sciaenidae and the Pleuronectidae make up the bulk of the catches.

The question arises then as to whether this fall in the volume of catch per craft indicates the beginning of overfishing of the north-west African Atlantic grounds. This may well be the case where the Moroccan offshore waters are concerned, since there, returns from fishing have fallen to a very low level. Also, there is a definite biological imbalance discernible as a consequence of the selective removal of a section of the normal fauna by trawling. Attention, however, has also been drawn to the considerable increase in cephalopod catches on the Saharan coast banks. Certain observers view this increase as a consequence of changes in the biological equilibrium between species resulting from the decline in fish stocks - Sparidae in particular. This is one problem that merits serious study, since the data so far available are insufficient to verify the hypothesis.

The problems arising in the study of Thunnidae found in the region have also been tackled. Here, biology and ecology are still insufficiently understood, despite current research on migrations. An expansion of tagging operations is desirable, in

particular where Neothunnus albacora and T. thynnus are concerned. Attention has also been drawn to the importance of the Cape Verde zone, where Parathunnus obesus and N. albacora are fished, and fry of these two species have been encountered.

(b) Survey of fish stocks

On a more general level, surveys of the north-west African fisheries are noteworthy in that they give rise to a series of special problems, whose complexity should not be under-estimated, if it is the intention to establish a coherent research plan.

In the first place, the large number of species - over 700, some 200 of which may be considered commercial - demands the compilation of a list of those making up the bulk of the catches. These should be the subject of special study.

The frequent difficulty in distinguishing the various component species within one and the same genus has also been pointed out, and recommendations have been made for the introduction of immuno-hemato-serological methods. The methods in question offer an invaluable supplement to biometric research, where results are often difficult to interpret due to the alterations of the meristic and biometric features of the fish under study which take place during growth.

The paucity of data on growth and mortality and on the reproduction of the main species, as well as on the size and age distribution within stocks, is also noteworthy. This is due to the fact that no regular sampling of catches has hitherto been undertaken - or has been attempted only in the last few years and even then only over a narrow range of species such as Clupeidae, Scombridae, horse-mackerel and a few Sparidae.

It is in any case difficult to interpret data so collected, since the natural factors likely to cause the formation of growth marks on bone parts are insufficiently understood. Nor has spawning frequency been determined. Certain species apparently have two spawning seasons a year and it is important to ascertain the potential incidence of this phenomenon on recruitment and on the possible constitution of local populations.

(c) Statistics and fishing intensity

The fear was voiced several times at the Symposium that the fishing grounds off north-west Africa were already being overfished. On the other hand, it became clear that most of the data necessary for making a meaningful estimate of stocks were lacking, and that this was also true of the data necessary for determining the effects that conservation measures might have on such stocks.

The total landings from north-west African waters should be somewhere in the region of 1 million tons fish and 200,000 tons cephalopods. Here again, only estimates are available, a fact brought out by the much higher figures advanced by certain participants who are of the view that mollusc fisheries have increased considerably over the last few years.

There are three reasons for this uncertainty as to the abundance and composition of catches: (a) a large portion of the catch is not landed in the region or is landed only in transit toward the far-distant markets of Europe and Asia; (b) in most of the non-coastal states there is no established vernacular nomenclature for the species mentioned in the returns; (c) the diversity of fishing methods, power ratings and tonnage of craft working this area make it difficult to collect statistical data. In statistics, as in biological and related research, a major effort must be made to establish a catalogue of species and to prepare logbooks and forms enabling those concerned to estimate catches and fishing effort. Without these data it is impossible to assess the present intensity of fishing off north-west Africa.

Conclusions

The general feeling at the Symposium was that the stage of basic studies had been passed and that there was by now sufficient general intelligence available on the marine environment and the marine fauna off north-west Africa to warrant turning research effort toward gaining a better understanding of the problems arising in the exploitation of the natural resources of the region.

For this, however, three conditions, it would seem, have to be satisfied. In the first place, existing data must be brought together in a central location for subsequent dissemination in synoptic form to facilitate their use by specialists in fisheries problems and ensure that they may serve as a basis for development of research programmes.

In this way, the information already available on physico-chemical oceanography and upwelling should provide enough evidence on which to make synoptic charts and define the standard oceanographic cross-sections for a study of fluctuations of these phenomena and their influence on the productivity of the region and on the ecology of the species encountered there.

The same may be said of plankton. Research might be profitably directed, on the one hand to identifying eggs and larvae of fish and the conditions governing their development and, on the other hand, to ascertaining the potential relationships between plankton, or its constituent elements, and abundance of certain commercial fish species.

The second condition concerns fisheries research in the strict sense. While it is true that the species frequenting the region are well known and the associations they form within the three provinces of the zone reasonably clearly defined, it is still necessary to draw up a list of those species whose detailed study is most urgently required. In this way an idea will be obtained of commercial stocks, their characteristics can be described, and the influence of natural factors on their constitution or the impact of fisheries on their evolution and abundance investigated. In this connection, the introduction of some system of collecting statistics and information on fishing effort is essential.

The third requisite concerns the coordination of effort at an international level, both in order to organize and conduct research and to compile and process statistical data. This could be done under the auspices of existing international organizations, and in any case with their collaboration, as proposed by both Dr. Went, President of ICES and by Dr. Ruivo, representing FAO.

Such collaboration between individual countries and international organizations is all the more essential in view of the magnitude and urgency of the task - magnitude, by reason of the mass of data to be collected and urgency, by reason of the constant development in fishery activities. And a further reason may be found in the resultant need to establish the bases for the scientifically planned exploitation of marine resources.

5. SECTION REPORTS

5.1 General Faunistics

Cl. Maurin, Chairman
J. Blache, Rapporteur

The North West sector of Africa is one of the richest areas of the globe in terms of fish and marine animal life. The particularly favourable environmental conditions

are the reason for this. The area, exploited since the turn of the century by Spanish, Italian, French and Portuguese fishermen, has during the last ten years become a centre of activity for new fishing teams from the U.K., Greece, Israel, Japan, the USSR, Poland, etc. Every year, one to one and a half million fish, cephalopods and crustaceans are caught in these waters. However, signs of overfishing already seem to be appearing; since precise data are lacking it is not possible to gauge the importance of this overexploitation nor to ascertain the actual state of the stock. In fact, despite the numerous oceanographic vessels which have prospected this region since the second half of the 19th century, until a very few years ago it was a long way from being one of the better-known regions of the globe from the standpoint of marine biology or of fisheries oceanography.

The initial observations were made en passant during expeditions or projects of greater importance. It was only long after oceanographic research began that the investigations took on a more systematic character. They gave rise to varied but more precise observations the purpose of which was to study the benthos, marine sediments or the nectonic (swimming) fauna. It was in this way that while studying in detail one particular geographical sector of this North West African region it was realised that many fishes or invertebrates which were believed to belong to well-known forms were in reality distinct species or subspecies. When this was discovered, great confusion reigned for a long time in faunistic circles and it is only since local laboratories have been set up that the study of specific life histories and of ecology has allowed a certain number of problems to be resolved.

Be that as it may, the areas of knowledge have more often than not remained restricted to the shallower waters. A matter of only ten years ago, papers dealing with the ecology and natural history of grounds at depths in excess of 200 m in these regions were extremely scarce if not non-existent. Though the majority of the species frequenting the shelves or the abyssal depths are known, only little is known of the benthic animal communities and the ichthyological associations living near the sea bed.

This discordance between the development of fisheries and that of scientific knowledge has rendered a re-examination necessary, and this originated the idea of calling this symposium.

State of knowledge prior to calling the symposium

The faunistic history of the West African Atlantic falls into two main phases. The first corresponds with the era of discovery and description during the course of which an initial inventory of the fauna was carried out; for the reasons stated above, this inventory was considerably lacking in precision. The second phase is that of investigations conducted in a systematic manner. It concerns the faunistics and, to a lesser extent, the ecology and biology of the species.

(a) The period of discovery

The observations made between 1873 and 1910 were mainly carried out on board oceanographic vessels; the first ones were, quoting only a few names among the more famous, the 'Challenger', the 'Travailleur', the 'Talisman', the 'Melitta', the 'Chazalie', the 'Valdivia', the 'Princesse Alice I' and 'II', the 'Hirondelle II' and the 'Michaël Sars'. There then followed the work carried out between 1920 and 1950 on board the 'Dana', the 'Discovery', the 'Mercator', the 'President Theodore Tissier', the Spanish trawlers 'Albrego', 'Cierzo' and 'Atiza', the oceanographic vessels 'Xauen', 'Malespina', 'Tofino' and 'Atlantide'.

Nonetheless other investigations were brought to fruition by naturalists who lived in the area or had come to assess the importance of the marine resources capable of being exploited. Such was for example the object of the expeditions led by Gruvel from 1905 onwards and by Lozano Rey from 1934 onwards.

As far as fish are concerned the authors who contributed towards the establishment of a primary faunistic inventory are numerous. We are giving as complete a list of them as possible elsewhere in a bibliographic note. At the moment we are only citing Bowdich, Valenciennes, Lowe for the Madeira/Canaries region, and Bleeker, Troschel, Brito-Capello, Baader, Steindachner, Rochebrune, Osorio, Vaillant, Pietschmann, Pellegrin, Zugmayer, Metzelaar for the African coast.

Investigations on invertebrates have not had the same importance and the same range except perhaps for crustaceans and molluscs. In this field should be cited Milne-Edwards, Bouvier, Chevreux, Pallary, Dautzenberg, Bavay, Locard, Koehler, etc.

Parallel to these investigations or as a result of them, the boundaries of the faunistic provinces or regions concerned were defined. Initially, Forbes included this West African zone with the neighbouring areas; Mediterranean, West Iberian coast and the Gulf of Gascony. In fact he recognized a certain affinity between the marine species living in these regions and created for them a single province which he designated Lusitanian.

Later on, as knowledge advanced, naturalists gave to this Lusitanian province the name of Atlanto-Mediterranean and divided it into three regions.

Lusitanian, from the English Channel to Gibraltar
Mauritanian, south of Gibraltar
Mediterranean

As we shall see, the boundaries given to these regions were arbitrary and did not always correspond with the reality.

(b) The period of systematic investigations

We may include in this period certain investigations on fish systematics conducted from 1925 onwards, notably those of Chabanaud, Monod, Norman, Cadenat and Belloc. However, it was mainly after 1950 that publications began to become numerous, on fish and on invertebrates. Among names to remember for fish we are citing those of Poll, Furnestin and colleagues, Dollfus, Cadenat, Lozano-Cabo, Cervignon, Roux, Bauchot, Nielsen, Delais, Blache, Aloncle, Collignon, Maurin. To these should also be added the initial observations made by Bonnet, Duclerc and Maurin in relation to the investigations carried out in Rio de Oro and in Mauritania by the oceanographic vessel 'Thalassa' in 1962.

In general among bottom fishes the hake (*Gadidae*) seem to have been studied best. Then follow the *Sciaenidae*, *Sparidae*, *Lutjanidae*, *Apoda*, *Heterosomata*, *Sphyraenidae*, *Scorpaenidae* and *Triglidae*. Among surface fishes the most numerous observations concern the *Thunnidae* (notably *Thunnus albacares*) and *Clupeidae* (*Sardina pilchardus*, *Sardinella aurita*, *S. maderensis*, *Ethmalosa fimbriata*, etc.).

Among invertebrates the best-known groups are the crustaceans, notably the crawfish (*Palinurus mauritanicus*, *P. vulgaris*, *Panulirus regius*), deep-water shrimps (*Aristeus*, *Aristeomorpha*, *Parapenaeus*), and *Brachyura* and *Paguridae*. After these come the gastropods, lamellibranchs and cephalopods, then the echinoderms.

Examination of all these documents prior to the symposium gave rise to three main observations:

a) The fauna populating the continental shelf and the Moroccan bank is related to that caught in the coastal Atlantic waters of the Iberian peninsula.

b) The fauna of the Saharan coast exhibits a certain character of its own but the majority of the species of which it consists exist in neighbouring zones. As far as the fish fauna is concerned its originality consists principally in the extreme

abundance, one could say proliferation, of certain forms which are present, but rather rare, in the neighbouring zones.

c) Even taking into account the sometimes considerable seasonal variations which can affect species distribution, Cape Blanc and the Banc of Arguin constitute a very important faunistic boundary.

As regards floristics, the algae of Morocco have been the subject of numerous and precise studies. The same cannot be said for those of the Canaries, Rio de Oro, Mauritania and Senegal for which only fragmentary information is available.

In the field of the bionomics and ecology of the sea bed the majority of publications have as their main aim the study of fishing grounds. The most important are those of Gruvel for Morocco, Belloc for the West African coast, those of Navarro and of Lozano-Cabo for southern Morocco, Rio de Oro and the Arguin bank and very recently that of Maurin for Morocco, Rio de Oro and Mauritania. In this field much still remains to be clarified, particularly for the region between 17°N latitude and Cape Verde.

Discussions and recommendations

The general discussion which followed the presentation of the contributions on algae (Nos. 5, 23, 24) revealed that the distribution of the investigations carried out up to now is not a rational one. The areas prospected are too limited and too disseminated. It is therefore advisable, in consultation with the research workers, to further develop research on this subject. Since algae are at present of great economic interest and the collecting grounds are becoming more and more restricted, the most urgent item appears to be the rapid preparation of an inventory of algal species and resources.

With regard to the papers dealing with the general fauna (Nos. 4, 30, 41), these have given rise to notes on the presence of Pennaeus keratourus in Rio de Oro and on the existence of two northern species, Homarus vulgaris and Patella safia as far as the latitude of Cape Bojador.

With regard to ecological work (Nos. 36 and 56) it has been stressed that the distribution of plankton provides evidence for the existence of an Ibero-Moroccan group, clearly differentiated from the tropical group from which it is separated by an intermediate zone; this coincides with data obtained by examining the fish fauna and is confirmed by the very specialized hydrological characteristics of the Cape Blanc region.

Following up an examination of communications Nos. 2, 6, 58 and 66, attention is finally drawn to the changes which have occurred in the ecology of trawlable beds in Northern and Central Morocco and in the composition of stocks of benthic species, and on the resultant necessity for the attentive examination of trends in these stocks which appear to be in the process of being overfished.

There are large gaps in the inventory of the fauna and flora and in the knowledge of the nature and the ecology of the sea bed. The activities of coastal laboratories and of interested countries should allow these to be filled in during the course of the next few years.

The organizers of the symposium have been particularly requested to endeavour to encourage countries which are exploiting the marine resources of the North West African continental shelf to make public property of the documents or information they have been able to gather on the nature and ecology of trawling grounds.

With regard to the flora it is recommended that a general inventory be made of algae capable of being exploited, now that a card-index compiled from aerial photographs has been established.

Moreover, signs of over-exploitation of trawling grounds are appearing in several sectors of the region under study. This needs particular attention on the part of the competent authorities and a complete study of the stocks on the part of the research workers.

Lastly, in the field of general faunistics, it seems opportune to propose a change in the naming and distribution of faunistic provinces and sub-provinces of the north-western Atlantic region.

This proposition, which has the agreement of members of other committees (fish, plankton, hydrology) may be summarized in four points:

- a) to include the Moroccan fauna in with the Atlanto-Mediterranean province, Lusitanian region, which because of this could be named Ibero-Moroccan,
- b) taking account of the seasonal variations which affect a proportion of the fauna in these regions, to consider the fish fauna of the Rio de Oro as forming part of the Atlanto-Mediterranean province, even while constituting a region of its own, the Saharan region,
- c) to make the sector of the Arguin bank and of Cap Blanc the boundary between the Atlanto-Mediterranean province and the tropical African province,
- d) to unite the fish fauna of Mauritania and of northern Senegal with that of Guinea to make a new region which would need to be given a name.

It is to be noted that the two regions situated on both sides of the Arguin bank form transitional zones between the faunas of the Ibero-Moroccan region on the one hand and the Guinean region on the other hand.

5.2 Physical Oceanography

Ch. Allain, Chairman
N. Menendez, Rapporteur

Recapitulation of earlier work

The oceanographic expeditions which have been carried out between the Straits of Gibraltar and Cape Verde, more numerous in the north than in the south, provide a general idea of the hydrological conditions in this sector.

The sections charted during the course of the great expeditions and abutting the African coast give information to start with on the thermohaline structure of the ocean where the great oceanic formations, the central water of the North and South Atlantic in the upper layers, water of Mediterranean influence and antarctic water, both intermediate, and deep arctic water, rise over each other or oppose each other above the great deeps.

On the continental shelf more detailed studies have been carried out, notably in the Moroccan sector where they have given rise to seasonal observations. They have brought to light an important upwelling whose intensity increases in summer when the dominant northeasterly trade winds are blowing and which appears starting from very localized centres separated by fronts of oceanic water. These ascending movements bring towards the surface water which is colder and also denser than the subsurface layer, giving rise to local cyclonic movements which largely divert the general NE - SW current (Canary current) which flows parallel to the coast.

In the sector which extends from Cape Juby to Cape Verde, the scarce data which we possess allow of the statement that the upwelling is active the whole time but

diminishes in intensity in the southernmost sector. In effect the surface waters, locally heated and also under the influence of a flow from the equatorial sector, come into direct contact with cold subsurface water which has been diverted to a greater or lesser degree, a contrast which is expressed in a very pronounced thermocline.

The chemistry of the sea is poorly known in the whole of the sector under consideration. Some observations, however, have been made on dissolved oxygen. The oxygen level is relatively high in the surface layer in the north and decreases towards the south. It also diminishes with depth as the intermediate Mediterranean and Antarctic layers are reached and decreases still more on reaching the formation of Guinean origin.

It is already clear from the above facts that future oceanographic studies ought to be more particularly directed on the one hand to the extent and variations of upwelling, which has a definite effect on productivity and in consequence on the development of the various links in the nutritional pyramid, and on the other hand to the hydrological front at which the southern and northern formations meet and which oscillates around Cap Blanc.

New data acquired from the contributions presented at the Symposium

Apart from one review (No. 63), almost all the papers (Nos. 18, 33, 42, 47, 48, 55, 76) dealt with the manifestations of upwelling on the margin of North West Africa and are in one way or another a continuation of the work of FURNESTIN (1959) on the Moroccan region.

In a general way these new data confirm that it is during the summer months, at the time when the trade winds are dominant, that the upwelling attains its maximum intensity, between Cape Juby and Cape Verde. This persists until the end of autumn. However, considerable variations can appear at any time, from one year to another, from one month to another and even during the course of diurnal observations in the selfsame place, as repeated hydrological and flow measurements from fixed stations have shown. The mechanism in fact depends on meteorological conditions, which vary with place and time, and is found to be affected by the topography of the sea bed.

The phenomenon continues, attenuated, in winter and early spring, even when the winds are variable or light. The causes of this latter anomaly seem difficult to delineate; setting aside a certain degree of inertia, there remains to be considered the effect of deep divergences and also the density distribution with respect to the general current. Upwelling of water has furthermore been observed south of the Canary Islands and should be attributed more to the topographic situation than to wind action.

South of Cape Blanc where upwelling is continually active the surface layer is affected by water of southern origin conveyed by a branch of the equatorial counter-current which flows against the coast of Guinea and is recaptured to a greater or lesser degree by the cyclonic eddies which develop on the continental fringe. The influence of Central South Atlantic water is still perceptible down to a depth of 300 m on the slope of the Bay of Arguin, at least until the end of autumn.

The very mixed coastal waters are unceasingly affected by fluctuations in oceanic waters and follow their variations, often with a certain time-lag, as is the case in the bay of Lévrier where it would seem that their action is at the moment less than during the period 1953 to 1955.

The major features of the circulation, brought to light by certain data collected between 1957 and 1966 between the Canaries and Cape Verde, show that the 'Canary current' flows throughout the year in the ocean off the North West African coast and that it is more intense in the winter. In the same way as on the Moroccan margin, a certain number of cyclonic movements divert it from the coastline, precisely in the centres where upwelling is most active.

As one would expect, it is in the zones of upwelling that the upper layer is enriched in nutrient salts, though the distribution of these elements does not coincide exactly with that of temperature and salinity. In certain instances the topmost layer becomes depleted of nutrients when biological activity is particularly intense.

The new data obtained in recent investigations thus supplement, confirm and make more accurate those acquired through earlier investigations on the margin of North West Africa.

There are still many gaps in our knowledge concerning the changes in space and time of the phenomena observed, notably on the extremely variable mechanism of upwelling and on the displacement of the hydrological boundary around Cap Blanc which marks the furthest advance of southern waters and which has an important role in species distribution.

The study of these variations, essential for the guidance of fisheries research, can only be carried out by comparing simultaneous observations in the areas under consideration. Special programmes such as the one planned to be executed by the 'Meteor' in the months to come, by providing for regularly repeated measurements from fixed stations and measurements registered by several buoys distributed in the critical sectors, will undoubtedly bring fresh information on the variability of upwelling.

It is, however, necessary to make immediate provision for carrying out a common study of the whole coastline extending from the Straits of Gibraltar to Cape Verde.

Discussions and recommendations

Consequent upon the discussion aroused by the various contributions, such as the project presented by M. Menendez on a study of the marine environment (No. 79) and the report by J. Smed on existing data (No. 25), a certain number of desiderata have been put on record, a list of which follows:

1) The various subjects dealt with during the course of the Physical Oceanography Section reveal the need for carrying out a common study of the coastline of North West Africa.

2) To this effect it is necessary to make an initial inventory of existing data, to draw up mean synoptic maps of temperature, salinity and, possibly, chemical factors.

It is put on record that the data centre of the hydrographic service of the ICES should collate on this occasion a large number of observations supplied to it over many years by the member countries of this organization.

Appeal should further be made to other centres of national and worldwide data.

3) In the future programme it would be desirable to arrange for the drafting of surface synoptic charts which could be drawn up according to the data furnished by liners on regular routes, merchant ships, oceanographic vessels and laboratories whose activities cover the area in question.

4) These data would need to be supplemented by meteorological observations, and an appeal to this effect would be made to various national and international centres specialized in these matters.

Attention is drawn to the fact that Spain is planning to set up a meteorological centre on the Canaries.

5) The choice of a series of oceanographic sections designed to further the knowledge of the process and variations of upwelling and of phenomena peculiar to this region can be decided on after examining the results already acquired in this field. This would involve the establishment of radials leaving the following points:

Cape Spartel, Fedala, Mogador, mouth of Wadi Draa, Cape Juby up to longitude 19° W passing immediately south of the Canary Islands, Villa Cisneros, Cape Blanc (Mauritania), Noukchott, Cape Verde up to longitude 27° W passing immediately south of the Cape Verde Islands.

The final location of these various sections would be determined in each instance after the preliminary study mentioned in point 2.

The observations would be carried out seasonally; the measurements would refer to the entire range of physicochemical factors and would be associated with plankton sampling.

This programme could only be carried out with the cooperation of several oceanographic vessels which would work simultaneously in sectors to be specified in advance.

The agreed network could be expanded to a more extended zone according to requirements and after examining the suggestions which would later be made by the countries interested in this project.

6) For the purpose of dealing with the various problems raised by these recommendations it is suggested that a working group, the composition of which would be determined after consultation with interested international organizations, should meet during the course of the year.

During the course of this meeting the various representatives of the participating countries would need to bring all the necessary material for discussing the implementation of the various points set forth in the present document, particularly as regards the drafting of synoptic charts.

5.3 Plankton

M.L. Furnestin, Chairman
T.S. Neto, Rapporteur

Knowledge about plankton in North West Africa

The report of the Section Chairman has been drafted in the light of the notes supplied by the Symposium organizers asking not to neglect "the assistance which a knowledge of the plankton can bring to bear on the study of fishery problems".

This would therefore not be a question of listing types of plankton but of separating out general information, pointing to gaps in our knowledge and of indicating the most useful course for future research.

On the quantitative level, emphasis needs to be placed on the geographic and seasonal variability of planktonic abundance in the area and especially on the remarkable abundance in certain regions, particularly between Cape Blanc (Mauritania) and Cape Verde.

This abundance has been demonstrated in various ways; counts of planktonic organisms, volumetric measurements, measurements of primary productivity using ^{14}C , and weight estimates. Its fluctuations are related to the dynamic phenomena which occur along the West African coastline of which upwelling, which enriches the sector periodically, is one of the principal and best-known ones, while the poverty of certain zones is explained by the expansion at the surface of bodies of diverging water.

These statements show that the study of the planktonic abundance of a region is inseparable from that of local hydrology and marine current flow.

On the qualitative level, analyses of phytoplanktonic and zooplanktonic populations show that the composition of microplankton is practically known; the authors have further considered the seasonal succession of populations (in diatoms and dinoflagellates for example), some phenomena of red waters (dinoflagellates), as well as the nanoplankton of the aphotic zone which is particularly rich in the open sea off Senegal. On the other hand, the relationships of phytoplankton with the physicochemical environment, hydrology and with zooplankton populations have not been examined.

Despite the already very numerous studies, the composition of the zooplankton is known only imperfectly. Also, what is known has all too often remained purely faunistic, dispersed and unlinked with the other aspects of oceanography. When species surveys are being carried out it would be desirable to develop the study of their ecology and biology so as to consider the zooplankton from viewpoints other than those pertaining to systematics. Planktonic forms should thus be examined from the following aspects: forms indicative of hydrological phenomena, components characteristic at the biogeographical level and components of the nutritive plankton or trophoplankton.

It would also be desirable that the study of planktonic groups be taken up again in a more general context, involving not only the bulk of planktonic communities but also their relationships with the physical and biological environment.

Investigations of this type are very few in number and refer to studies of the Moroccan zooplankton and of the plankton of the Bay of Dakar, each of them representing an attempt at a regional synthesis by individual authors. For the other regions, much scattered information is available which if collated would result in syntheses of the same kind. On the other hand, the sardine, Sardinella species or the tunas are likely to become, as Sardinops ocellata on the South African coasts, the most attractive subject for research, also in the field of related planktonology.

The biogeography of African plankton populations is poorly known, a floristic and faunistic inventory not having been produced. However, for the phytoplankton, diatoms and dinoflagellates, as well as for the microzooplankton represented by the Tintinnidae, close relationships have been observed between the North West African populations and those of Southern Europe. For the macroplankton the data are more subtle; while the Medusae and pelagic molluscs of the Moroccan coast show clear tropical affinities, the Mysidacea on the other hand have boreal affinities. The group Chaetognatha is quite meaningful if the neritic and semi-neritic species are considered. Their study reveals a uniform population over the entire Ibero-Moroccan region, covering the coast of Portugal and the bay of Cadiz and the Moroccan coast. However, an important modification in their population occurs at Cape Blanc in Mauritania. It is in fact there that the inter-tropical facies for this group begins, which extends to Cape Frio where it gives away to the South African facies.

Finally, after taking into account the difficulty of using the planktonic constituents as biogeographic indicators, an Ibero-Moroccan group can be recognized, having a dominant temperate character often enriched by tropical contributions to the most pelagic forms. Cape Blanc is a crucial zone representing the northern limit of the intertropical population. It is interesting to note that the distribution of fish leads to the same conclusions.

Data furnished by the contributions presented at the Symposium

These are:

1) of faunistic type, concerning the copepods (No. 26) and the Siphonophora (No. 27) of the Cape Verde Islands, whose lists are supplemented by observations on the ecology of certain species;

2) relative to the ichthyoplankton, retracing the development and distribution of the eggs and larvae of Trachurus trachurus (No. 64) and expounding the work programme of the Gorée marine station and of the oceanographic centre at Dakar-Thiaroye for the study of the larvae and juvenile stages of fishes of the Senegal coast;

3) relative to the planktonic larvae and planktonic feeding of crustaceans; including studies on the phyllosomes of species of the genus Palinurus on the continental shelf of the Spanish Sahara (No. 68) and on the diet of Penaeus duorarum, a West African coastal shrimp, of which several developmental stages are constituents of the plankton;

4) of a general nature, as in Report No. 21 which points out various trends in present-day research on plankton in North West Africa and out of which certain proposals have been recorded; lastly, document No. 52 concerns investigations on productivity carried out in the Mediterranean under the aegis of the NATO sub-committee on oceanography which are mentioned as an example of what could be done in the Western Atlantic area.

Guidelines to be considered for planktonological research in North West Africa

These are of varied nature:

- Even if the inventory of planktonic forms is well advanced despite the difficulties connected with the species diversity of the tropical zone, the groups holding a major position in the nutritive plankton, crustaceans in particular, would need to be studied in a more intensive manner. A particular effort should be made in the analysis of deep-water populations on both the qualitative and quantitative levels. It would further be necessary to link the regional studies on this subject in order to arrive at a complete knowledge of the planktonic population.

- The concepts of productivity and biomass need to be given the highest degree of attention. Measurements of productivity need to be multiplied in space and time in order to interpret with greater precision the geographical and seasonal aspects of marine fertility. The biomass of the zooplankton ought also to be evaluated, according to species, either as total biomass for one region at a set point in time, or as biomass as related to a given species of particular interest from the standpoint of nutritive value. Furthermore, the relationships between the two great planktonic communities, plant and animal, would need to be elucidated, casting light on phenomena of animal exclusions, evaluating the daily food requirements of the zooplankton and the extent to which these are covered by phytoplankton productivity, disentangling the role of plankton in energy transfer from one level to another in the food chain (suggestions from Mrs. K. Wiktor).

- There is much to be done in the field of plankton/fish relationships, which have been little explored though ichthyology itself is studied on a wide scale in the area.

It is recognized that the study of the ichthyoplankton comes within the scope of the application of planktonology to fishing, to the extent that the survey of eggs and larvae allows the pinpointing of spawning adults (spawning areas, levels and seasons) and the estimation of their density; the percentage of developing eggs assists in evaluating the vitality of the stock and its development potential, taking into account the intervention of larval predators; displacements of larvae, as determined by their physiology, food requirements or by ocean currents can likewise be followed; lastly, the logging and conservation of certain sites favourable for the development of the young fish can be carried out, and this is a factor not to be neglected at a time when the danger of over-exploitation is a reality.

A study of several of these aspects has been made on the eggs of sardines and anchovy in Moroccan waters. This has defined the spawning seasons and areas of these clupeoids as well as the effect of temperature on spawning, and practical conclusions concerning their fishery have been drawn. A new contribution of similar character, on Trachurus trachurus, has been presented at the Symposium. However, apart from these investigations, the interesting field which the ichthyoplankton opens up has hardly been prospected; even the lists of eggs and larvae identified in the sector are still very restricted.

The possibilities of using plankton as a halieutic indicator (a certain plankton species indicating the presence of a certain fish species when both populate the same type of water), or indicating the absence of other species whose environmental requirements are quite dissimilar (adverse indicators)) are not yet properly accounted for. Such investigations could be applied for example to the copepod Calanoides carinatus, an indicator for Sardinella in the Gulf of Guinea.

Plankton constituting food for fish is the third aspect of the question. This involves a concept of abundance, since concentrations of plankton can entail concentrations of plankton-eating fish. However, in the region we are concerned with, the diet of plankton eaters has not been analyzed. It would therefore be useful to indicate the plankton organisms forming the basic food of commercial species, then to assess their abundance, analyze their seasonal cycle and their annual or incidental variations so as to determine the times and places of their optimum development, which may be correlated with that of their predators.

The relationship between plankton and hydrology should not be neglected either. At several locations, the effects of confrontations between bodies of water of different natures and of coastal upwelling have been shown. These relationships, however, require more detailed analysis; in the case of phytoplankton, the relationship with the environment which govern its seasonal cycle should be examined; research is likewise required in the case of zooplanktonic organisms of high nutritive potential or of indicator organisms, on the lines of the work carried out on Chaetognatha whose ecology in African waters is now known.

It would, moreover, be necessary for hydrologists, planktonologists and ichthyologists to associate in a concerted study of these multiple relationships so as to supplement each others' observations, collate elements of information and interpret the results relevant to fisheries oceanography.

The various guidelines considered above for planktonic research in the area have been advanced on the one hand as themes for discussion during the session and taken up on the other hand as conclusions and recommendations of the Plankton Section.

Discussions and recommendations

Taking into consideration the remaining gaps in our knowledge, discussions and viewpoints recorded and also the demands of fisheries oceanography, several guidelines need to be given to North West African planktonological investigations.

1) On the faunistic inventory level, stress should be laid on the populations inhabiting deeper waters on the one hand, and on the crustaceans on the other hand (Cladocera, copepods, Euphausiacea, amphipods, decapod larvae), in view of their importance to the trophic plankton. It would also be necessary to coordinate regional investigations in order to get a comprehensive idea of the populations. It is considered useful to draft identification cards modelled on those of the International Council, and distribution maps of planktonic forms similar to those prepared for the North European Atlantic and the North Sea (cf. Bull.mar.Ecol. and Ser.Atlas.mar.Envir.)

2) Measurements of productivity (phytoplankton) and of zooplanktonic biomass, which are as yet limited, ought to be extended to interpret the geographical and seasonal aspects of marine fertility and to be applied to species having an important trophic role (copepods, for example). They would need to be included in an international programme simultaneously comprising planktonology and hydrology.

3) The analysis of the relationships between plankton and hydrology needs to be carried out in details and this would require investigations of local or periodic phenomena (confrontation of bodies of water, upwelling, divergences, currents ..)

determining concentration or scarcity of the plankton; research on hydrological indicators (Chaetognatha, Medusae, Siphonophora, Salpida, pelagic molluscs, Foraminifera); elucidation of the seasonal phytoplankton cycle as related to the physicochemical environment and of the same relationships for zooplanktonic forms of high nutritive potential (crustaceans in particular). However these relationships will only be discernible if the physicochemical and hydrological data are supplied in a simplified form of direct use to biologists.

4) The relationships between plankton and fish are among the most important ones to disentangle:

- a) investigations of the abundance, as well as of annual, seasonal, or incidental variations; of sites and conditions of aggregation of plankton organisms making up the diet of commercially interesting plankton eaters which should be identified by analyses of stomach contents;
- b) research on halieutic indicators (favourable or adverse);
- c) study of the ichthyoplankton; distribution, density and viability of eggs and larvae of commercial fish, in order to determine the spawning areas and seasons, and the importance of spawning populations and recruitment;
- d) action by predators of larvae (Ctenophora, Medusae).

To sum up, an orientation towards applied planktonology is required insofar as it can supply valuable assistance to fisheries oceanography, but also fundamental Planktology, which is essential for any serious research in this field, should not be neglected.

5.4. Crustaceans and Molluscs

H. Vilela, Chairman
R. Monteiro, Rapporteur

Knowledge acquired to date

The papers on crustaceans (No. 7, 59, 61, 68, 70) and molluscs (8, 19, 31, 34, 67, 69, 77) presented to the Section and the discussions which followed, provided an idea of the present state of their exploitation as well as of our knowledge of the various aspects of the biology of these animals in the sector of the Atlantic considered here, despite the insufficiency of the data available as yet.

The twelve papers presented dealt in fact in a general way with all of the edible or useful crustaceans and molluscs in the area as well as with those whose exploitation is expected to be economically profitable.

It has been recognized that it would be necessary to increase and deepen this knowledge so as to be able to advise on the adoption of measures designed to protect the stocks of certain species and to regulate the exploitation of others.

With regard to the Crustacea of which the decapods are the only really important ones, attention has been particularly drawn to the shrimps and crawfish, though the possibility exists of developing the fishery of certain Brachyura in the future. The shrimps, Palinuridae and Homaridae are much sought after but in the absence of regular, accurate and detailed statistics the exact total of catches and their fate are not known.

The shrimps of the genus Penaeus (coastal species) and those of the genus Parapenaeus (P. longirostris (Lucas)) have been found to be the most important, but there are others which should not be neglected either. Fishing for Penaeus

(P. kerathurus (Forsk.) and P. duorarum (Burkenroad)) offers good prospects in estuaries; trawling is the fishing method of the future as far as Parapenaeus spp. are concerned as well as for deep-water species, provided that catches will not exceed the potential of the stocks.

Interest in fishing for crawfish is continuing to increase. Lobster-pots, trawls, basket traps, nets and diving are the most widespread fishing methods. The produce is marketed either live or frozen.

With regard to molluscs the importance of fishing for cephalopods, catches of which have increased in the last few years, seems to be related to the impoverishment of stocks of certain species of fish, particularly Sparidae, which used to be very abundant previously. Their sales, particularly as frozen produce, have increased considerably. Trawling is the main fishing method.

The lamellibranchs, of which many species are used for human consumption and for other purposes, have not attained the same economic importance as the cephalopods; all the same it is necessary to envisage the possibility of developing the culture of some species whose exploitation could be of economic interest. This is the case for oysters of which the most interesting species in decreasing order of importance are Crassostrea angulata (Lamarck) in the northern part and Crassostrea gasar (Adanson) in the southern part of the area. The attempts made up to now are not discouraging despite a number of setbacks.

For rearing oysters in Morocco one could perhaps count on the existing natural bed at Larache without excluding the use of spat from the nearest European beds.

The above-mentioned lack of statistics on Crustacea is equally true for molluscs. It seems that in addition to regularity in the collection of data it would also be necessary to break down these data in order to collate species or at least groups of closely related species. The gaps in the current statistics are evident.

To sum up one can point out as the most noteworthy of the session in the Crustacea and mollusc section the following facts, which have given rise to three recommendations already included in the section proceedings (see page 19).

As a result of excessively intensive fishing in the area, the stocks of several species of fish have been depleted or have even disappeared in certain regions. This has had repercussions on the abundance of other organisms, among them Crustaceans and molluscs.

The animal communities of the area have undergone a change, cephalopods having taken the place of some species of fish, particularly the Sparidae. Catches of these molluscs have effectively increased recently, at least in some zones of the area.

On the other hand a decrease is noted in catches of shrimps or at least a tendency in that direction.

The importance of the area from the standpoint of fishery exploitation is becoming more and more evident, and consequently the need for expanding and deepening the research work is making itself felt.

The ICES therefore faces the prospect of extending or intensifying its studies in one area - North West Africa - which is already of great scientific and economic interest and which will most probably become more and more important in the near future.

Discussions and recommendations

The most important problem is that engendered by the faunistic changes which can be brought about by over-intensive fishing for certain species.

The biological imbalance thus created can be interpreted as a simple change in the relative abundance of species or by the replacement of one animal community by another, which would be the case in certain areas where the disappearance of Sparidae may have brought about an abundant population of cephalopods.

The weakening of certain stocks, shrimps in particular, has been noted and this problem, like the others, should stimulate research since these stocks are of great economic importance. In this respect a vast field of activity is open to ICES in the North West African region.

In conclusion, it would be desirable in the immediate future:

- 1) to consider the publication of identification cards for the most important Crustaceans and molluscs of the North West African sector containing information on their geographical and bathymetric distribution, their ecology, and methods and equipment used for catching them.
- 2) to study catches statistically with the aim of examining the depletion of stocks of certain species (fish, shrimps) and the expansion of certain others (cephalopods, crabs) which may indicate the substitution on the fishing grounds of species with high commercial value by species whose exploitation would hardly pay if at all.
- 3) to proceed further with the so far very sketchy study of deep-water shrimps, in particular the reproduction and nutrition of these crustaceans.

5.5 Fishes

F. Lozano, Chairman
J. Dardignac, Rapporteur

Knowledge acquired

On the continental shelf of the North West African coast the environmental conditions (topography, bathymetry, hydrology) are particularly favourable for marine animal life. Among these the fish are certainly the group offering the greatest interest for exploitation, without underrating the possibilities offered by the crustaceans and molluscs, particularly the cephalopods.

As regards the cephalopods, fishing for Octopus and Sepia is of unusual importance at the present time mainly because of the catches by Spanish and Japanese boats (No.69).

The geographical situation of this Atlantic region also explains the abundance and great variety of the fish fauna populating it. Both, Atlanto-Mediterranean species and Guinean species in fact occur there and reach the limits of their range within the area. Furthermore, this transitional zone has its own characteristic species (Nos. 36 54), and these considerations as a whole lead to the adoption of the biogeographical divisions proposed by Cl. Maurin (1968) in the section on general faunistics.

This natural abundance of fish is unfortunately imperilled. The exploitation of the North West African fishing grounds has undergone rapid and intensive development during the last few years and there are now in some cases signs of overfishing.

In our view, after having studied the development of trawl fishing on the African coast since 1941, the symptoms of overexploitation are very much in evidence, not only through the disappearance of the 'miracle catches' which used to be seen in 1941-1942 during which one ended up by capturing a ton of fish per minute, but also because - and this is more serious - the average size of specimens has decreased to a very considerable extent.

It would also be fitting to delineate what research work ought to be undertaken in the field of ichthyology for the purpose of rationalizing fishing activities in this region and by so doing safeguard its resources.

With this in mind, and after a brief review of the knowledge acquired to date, we shall attempt to define what the direction of future research work ought to be.

We must insist once more on stating that although it is very important to the Symposium to review what is known, it is more important still to determine what is not known so as to guide future research work with a view to filling the existing gaps.

The bibliography (Nos. 3, 37) dealing with the North West African coastline is extensive but the importance of certain works should be stressed. This concerns:

among the older works those of Bowdich (1825), Valenciennes (1835), Lowe (1839), Bleeker (1882), Rochebrune (1883), Vaillant (1888), Osorio (1890-1898), Zugmayer (1891), Vinviguerra (1893), Pietschmann (1906), Pellegrin (1907-1937), Metzelaar (1919), etc.

among the most recent those of Chabanaud, Monod, Norman, Poll, Cadenat, Frade, Lozano y Rey, Furnestin, Dardignac et al., Maurin, Navarro, Cervignon, etc. as well as our own from 1941 onwards. Fowler (1936) whose book is very useful even though the observations it contains were made on preserved specimens, should also be mentioned.

Even if the knowledge to date is very considerable, it appears to relate mainly to the field of pure science, and data usable for fisheries are rare. In fact, with the exception of the investigations on Sardinella spp. and the red tunny, those concerning bottom species refer above all to taxonomy and to geographic and bathymetric distribution. Furthermore, these observations, like those conducted on fish biology, are most often restricted in time and space.

Desirable orientation of research work and outline of the problems to be encountered

More than 700 species live on the North West African continental shelf, of which 300 are edible and 150 have considerable value for the fisheries. It is impossible within the near future to conduct research simultaneously on all these species, particularly since those species without commercial value which also contribute towards the biological balance ought not to be neglected. This is why a statistical grouping by genera and even by families has been proposed by F. Lozano (No. 14).

As regards species interesting for research but having no direct interest for fisheries, we may cite for example Synagrops microlepis, of particular importance in the diet of hake.

Also, in order to obtain practical results without too much delay it would be necessary to concentrate the investigations initially on the families of fish which constitute the basis for exploitation. According to the fishing statistics it seems that these families are: Sparidae, Serranidae, Lutjanidae, Sciaenidae, Carangidae, Gadidae (hake) and the flatfishes.

Lastly, attention needs to be drawn to two problems which though outside the scope of research work are closely bound up with the exploitation of fish.

The first one concerns the legal aspect of the question, since some concepts valid some time ago have now expired. Maritime waters have become a common heritage which consequently need to be the object of endeavours necessary for their protection on the part of all the countries concerned.

On the other hand the exploitation of a region, particularly when it is a remote one, would need to be complemented by an industrial infrastructure. Despite the continually increasing importance of factory ships it seems that the shore installations are clearly inadequate and that it would be desirable to create others comparable to the ones set up by the Japanese at Las Palmas and by the Mauritians at Port-Etienne.

Discussions and recommendations

Following on from the presentation of the twenty communications of interest for the section (Nos. 1, 9, 10, 11, 12, 13, 17, 22, 28, 29, 30, 32, 40, 45, 46, 51, 53, 57, 62, 66) several problems concerning the biology and ecology of tropical species were raised.

That of the separation of species or of the populations which they form is particularly difficult and here the use of serological and haematological methods could be of valuable assistance.

The existence of two distinct spawning periods in fishes from this area equally needs to be studied. In the case of Sardinella aurita where this phenomenon occurs it would be useful to know whether, as some have suggested, it is due to the existence of two sub-populations or to the existence of two warm and two cold seasons during the annual cycle, connected with the existence of two periods of upwelling.

This problem may perhaps also be posed for Thunnus albacares in which the size differences noted within the second year-class may be due to differences in the spawning period.

Lastly, as far as tunas are concerned, the interest in carrying out tagging experiments has been stressed, particularly as regards the red tuna in the Ibero-Moroccan region which is considered as a suitable site for the study of the migrations of this species and of the exchange between the populations of the Atlantic and the Mediterranean.

The following recommendations have been adopted:

1) to concentrate the research work on the most important groups of commercial fish, particularly the Clupeidae, Scombriformes, Sparidae, Serranidae, Lutjanidae, Sciaenidae, Carangidae, Gadidae (essentially the hake) and flatfish. Synoptic studies of these various groups would be desirable at a preliminary stage in the investigations.

2) to accord priority to investigations having direct practical applications such as:

- fishery oceanography, particularly in relation to pelagic fish, with simultaneous observations on catches;
- growth and composition of stocks in terms of size and age;
- haematology and serology.

3) to initiate international action for the study of the biology of the red tuna in the Ibero-Moroccan Bay.

5.6 Statistics and Stock Assessment

J.A. Gulland Chairman
L.P.D. Gertenbach, Rapporteur

Statistics

The importance of adequate statistics, already mentioned in other Sections, was emphasized. Presently statistics as made available by national statistical offices for international publication by ICES or FAO are very inadequate and often incomplete. Improvements are required in the species and area breakdown, and very little effort data are available.

Species

Some 700 species are present in the area, and over 100 are of potential commercial importance. Publication of statistics for all these would be impracticable, and therefore some grouping, by genera, family or larger categories is necessary. Some suggestions for such groupings were outlined, as were those presently used in some national statistics, but it was realized that detailed discussion was not possible during the Symposium. It was proposed that the forthcoming ACMRR/ICES Working Party on the Fishery Resources of the Eastern Central and Southeast Atlantic should examine this question in detail and suggest a list of the important commercial species, with Latin names (and often-used synonyms) and common names in the more important languages, and also suggest appropriate groupings of these species for reporting and tabulating statistical data.

The need for correct species identification at the landing place, or other point of origin of statistical data, was stressed; field identification sheets would help in this, and the production of such sheets could be a fruitful field of collaboration between ICES and FAO.

Areas

The boundaries of statistical sub-divisions should as far as possible coincide with natural boundaries of stocks; they should not cut across important fishing grounds. Because natural boundaries change, it is impossible for statistical boundaries, which have to be fixed, always to coincide with them, and have therefore to be to some extent arbitrary. The boundaries at present used by France and Portugal (the old ICES area) are some distance from the major natural boundary in the area, at Cape Blanc, and are also different from the proposed Japanese areas. The Working Group was, therefore, asked to look into this question, and to suggest suitable boundaries for sub-dividing the area. The suggestions should take into account the needs and problems of all countries fishing the area, African, European and Asian. A proper numbering system of the statistical areas should be used which removes the present duplication for certain Roman numerals, and which is comparable with statistical systems for other areas.

Attention was drawn to the possibility of using log-books, possibly from a sample of the total fleet, to obtain better data on fishing areas. This has proved successful in several countries, especially for larger vessels. A wider use of log-books seems desirable. If necessary, their use should be concentrated among a small section of the fleet so as to obtain more reliable results. The importance of maintaining close contact with the fishermen concerned was emphasized.

Effort

Internationally published data are almost non-existent (some data on fishing fleets; Polish trawling data). As a start it is proposed that long-range vessels should report effort data on the present North Atlantic system, and that for coastal fisheries better statistics on the size of the fleet, broken down by types of gear and size of vessel, should be made available.

It is worthwhile pointing out in particular that on the coasts of the Spanish Sahara, Sparus ehrenbergi and Parapristipoma mediterraneum appear at certain times of year and constitute 70 percent of coastal trawler catches. The Serranidae, particularly Serranus aeneus, are also very important in the catches, and we should not forget the Sciaenidae and principally Johnius regius which is the basis of the catches in the bay of Lévrier.

For each of these important families the investigations to be carried out would be of two types:

- in the first instance a synoptic study appears indispensable. It would, for certain of these species, and by collating all the partial results, allow more extensive and consequently more valuable biological information to be obtained. The elucidation of life cycles, in certain cases at least, would be very useful for formulating fishery regulations suited to individual species. A synoptic study would also permit the identification of gaps in our knowledge and subsequently guide the research work of oceanographic or fishery expeditions.

- in the second instance, the investigations ought to be more devoted to the inventory of stocks based on biometric studies and research on population dynamics. For this purpose statistical data on catches, as well as biometric observations, would have to be recorded periodically in determined regions so as to enable their comparison from year to year and in this way follow the development of the stock.

For this reason it would also be desirable as an immediate measure to create statistical groupings and to outline statistical areas delimited if possible on a zoogeographical basis.

The means for carrying out such a programme are primarily those at the disposal of the oceanographic institutions of the various interested countries. But this is not sufficient to ensure the continuity essential to these activities. It is necessary that fishing vessels lend their cooperation throughout the year by communicating in particular the yields of the fishing grounds in terms of species in relation to the fishing gear employed. In this connection the benefit of having one or several biologists participate in expeditions on board the trawlers should be emphasized. This type of participation has often been practised by the Spaniards, the Italians, and the Poles and - probably - by the Russians and Japanese as well.

Attention should also be drawn to the fact that it is not rare even nowadays, during the course of an expedition for new species to be discovered or to be reported for the first time in the region being explored.

We can cite two species of the family Ateleopidae, caught during the expeditions of the 'Abrego' (1941) and the 'Thalassa' (1962). On the first one we caught the second specimen of Ijimaia lopei known in the world. On the second one we were very surprised to find the second specimen of Melanoglaea ventralis which after a few days we were calling Melanoglaea communis because of its relative abundance.

Without getting as far as Latimeria chalumnae, the living fossil of South Africa, now present in several museums, one can also note the frequent presence on the African coast of such species as Grammicolepis brachiusculus, Makaira albida, Makaira nigricans, Tetrapterus belone, Acanthocybium solandri etc. which were completely unknown only a very few years ago.

Furthermore, the concepts of frequency and of abundance change greatly for certain fish. All these results are very interesting on the faunistic level but for the fishing industry they are most often not translated into any concrete assets.

Recommendations

The members of the Symposium, taking note of the severe shortcomings of presently available statistics, recommend that ICES and FAO, including its new Fishery Committee for the Eastern Central Atlantic (CECAF), take urgent action to arrange for the collection, tabulation and regular publication, in some suitable form, of fishery statistics for the area from the Straits of Gibraltar to Dakar, possibly in conjunction with the statistics of adjacent areas. The attention of ICES and FAO is drawn to the suggestions for species and species groupings, for area divisions, which may be put forward by the ICES/FAO Working Group.

Stock Assessment

Two papers dealing with the state of the stocks in the area were presented (Nos. 44 and 62). Portuguese data showed a steady decline in catches per unit effort over a long period, especially for hake. Russian data, for the period 1922-66, showed no change in catches per unit effort of mackerel and horse-mackerel and these stocks are probably not too heavily fished. Sparids declined up to 1965, but showed a recovery in 1965/66.

Several speakers earlier in the Symposium referred to the depletion of the stocks, especially of the more valued species in the area, and to the possible need for regulation. It seems probable that the abundance of several species, including the hake, has decreased, as can be expected when fishing increases, but it is not certain whether the total catch (from all countries) of these species has decreased. As already noted, the basic data of catches and effort are at present inadequate, at least in published form, as are data on size compositions, mortality rates, etc. In the absence of such data proper stock assessments cannot be made, nor can estimates be made of the effects of possible regulatory measures should these be required. It was believed that more data are available in laboratories than has been published, and scientists working in the area were urged to make such data available to the Working Group so that ICES, FAO and the new Fishery Committee for the Eastern Central Atlantic can receive good advice about the state of the stocks in the area, and the possible need for management, or possibilities for further development of the fisheries.

5.7 Fisheries and Utilization of Catches

A. von Brandt, Chairman
B. Diop, Rapporteur

The coast off N.W. Africa from Morocco to Senegal, including the Canary Islands, is an old fishing area of Iberian and French fisheries. Lozano (No. 37) mentioned the first French fishing project in 1685. Modern highly developed trawling was started by USSR (1957), Poland (1962) and other countries of Europe and the Far East. During the last years the area became more and more important, not only for foreign fleets, but also for the bordering countries. In these adjacent countries the fishery situation is quite different, when comparing for instance Morocco with a highly developed industry for canned fish; Mauritania, with a high production of freshwater fish and a low one of sea-fish, and Senegal with an important national fishery, big export to other African countries and a high fish consumption.

Fishery Activities

There are two different types of fishery activities: a traditional one with small gears but thousands of canoes, mostly in the national territory (except Rio de Oro, 12 miles), and an industrial one, operated by foreign vessels all year round or in a limited season only.

It is very difficult to get complete statistics for catch and effort, not only for the bordering countries, but even more for the foreign long-range fishing fleets. The main fishing area for foreign trawlers is between Cape Juby and Cape Timiris. Especially well-known is the Arguin Bank near Port Etienne (No. 43). Spanish fishing charts are available for the area from Cape Ghir to Cape Blanco (No. 38).

The main exploitation of Soviet trawlers takes place from August to April and usually at depths of 100 to 300 m (No. 62). Also Portuguese trawlers are fishing off the coast between 30° and 20°N during a yearly period of 3 months only (No. 44).

There are also some data on catch per hour or catch per haul, but it is difficult to compare them. Nevertheless, the yield of the catches in tons per hour is very often less than 1. Polish experiments on the fishing ground of Cape Timiris demonstrated that the fishing yield dropped along with the decrease in water-temperature and with the diminishing cloudiness (No. 17). Another Polish investigator (No. 35) mentioned an average yield per hour trawling (near Cape Bojador, April to June, at depths from 65 to 200 m) for freezer-trawlers from 2.8 to 3.9 tons.

Finally we note the growing interest of certain fishing fleets (USSR and East Germany) for pelagic species intended for processing (Trachurus and Scomber colias) while others such as the Japanese fleet composed of vessels of 300 to 2,500 tons, are mainly interested in catching Sepia and various other molluscs, as well as Dentex and other fishes of various species, each of these categories representing 25 percent of catches taken by day and night down to depths of 100 m.

Total catch

Nevertheless, the total catch of fish, molluscs and crustaceans in the area from Cape Spartel to Cape Verde of foreign and bordering countries is estimated to amount to about one million tons. This may be more when the high catches of cephalopods, as mentioned by Mr. Cabrera, are included. Only a few data on the catch are available (in thousands of tons) according to FAO statistics and other contributions.

Morocco	295.6	(1966)	Japan	90.0	(1966)
Ifni	3.2	(1964)	USSR	52.4	(1966)
Rio de Oro	2.3	(1964)	Ghana	14.8	(1966)
Canary Islands	130.0	(1965)	Ghana	10.7	(1967)
Mauritania	1.2	(1964)	Portugal	4.0	(1964)
Senegal	101.0	(1965)	(hake only)		
Cape Verde Islands	3.5	(1965)			

Main species

From the 150 fish of commercial interest a small group only is very important, viz. Clupeidae, Thunidae, Carangidae, Sparidae, and Scombridae (Nos. 35, 44, 62 and 80). Uniform catches are important for economic trawling in case great quantities are needed, not for the production of meal, but for human consumption. Polish investigations mention 50 to 60 fish species in one and the same haul. Nevertheless, when fishing at the right place, during the right season and time of day, Carangidae, Sparidae and Scombridae can make up 70 to 90 percent of the catch. Moreover, crustaceans, molluscs and algae are of interest for the fisheries. Well-known are the fisheries for spiny lobsters off the coast of Mauritania originally by French boats from Brittany.

Fishing gear

Traditional fisheries use longlines, traps (madragues for bluefin tuna off the coast of Morocco only), castnets, gillnets and small types of surrounding nets.

For industrial fishery, national or foreign, trawls and purse seines are important. It seems that midwater trawls with ~~headline~~ transducers could become a successful fishing gear in the future for semi-pelagic fish and for fishing over rocky grounds, and it may be of interest that fish caught by midwater trawls were in a better condition than those caught by bottom trawls (No. 20). High-opening trawls are also under discussion. More research in this field is needed. (Nos. 20, 65, 50).

Fishing vessels

A great number of canoes are used for fishing especially in Morocco, Mauritania and Senegal. The efficiency of these canoes can be increased by about 30 percent with outboard engines.

Foreign fleets use different types of large vessels, for example, Soviet stern-trawlers of 2,000 HP, sidetrawlers of 400 HP, and seiners of 300 HP (No. 65), and Ghana fishing with Norwegian sterntrawlers each of 1,600 GRT (No. 80). Mauritania owns 9 modern trawlers and Senegal 5 tuna boats.

Fishermen

There is a lack of good statistics about fishermen because the definition for the term "fisherman" varies in different countries. Only a few data are available (No. 75).

There is a need for training which is considered a very important fact in connection with fishery development. Mauritania trains young people in Port Etienne as experienced fishermen. Senegal established a fishermen's school for industrial fishing in 1963.

Fish processing

Traditionally, fish are consumed fresh, salted and dried, or smoked, if possible. In Senegal also fermented and dried fish have a good market. Some data about local consumption are given (No. 75).

There are canneries in Morocco and Senegal. In Morocco 80 percent of the total catch is sardines, most of which are canned for export. Concerning the price, canned fish appear in fourth place on the export list for Morocco. Fishmeal plants are found in Morocco, Rio de Oro and Senegal.

Most countries want to extend their fishing industry (No. 75). This is especially true for Mauritania with Port Etienne and Senegal with Dakar and St. Louis. Senegal now has five tuna boats but its fleet will increase in 1970 to 19 vessels and in 1972 to 25. A cannery for tuna is under construction for a capacity of 30,000 tons per year. This cannery also has arrangements for the production of canned pilchard in connection with the possibility of Sardinella fishery in territorial waters.

Conservation of stocks

The participants felt that international cooperation is urgently needed and recommended that all assistance should be given to the ACMRR/ICES Working Party on the Fishery Resources of the Eastern Central and Southeast Atlantic.

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2. Abstracts

No. 1
Fishes^{1/}
(F)

The Moroccan sardine and its fishery.
Feeding and spawning migrations in relation to
hydrology and plankton

by

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et Technique des Pêches
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and

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This report summarizes investigations carried out at the Institut des Pêches Maritimes du Maroc (1946-1954 and published up to 1959). They include biometric research on young and adult specimens, biological research on migrations of sardine, on the occurrence of eggs and larvae in the plankton and on location of schools by echosounding, a hydrological survey of the Moroccan Atlantic waters and a quantitative analysis of plankton.

The Moroccan race is defined by its biometric characteristics. Growth of these fish has been studied in the adult, larval and postlarval stages, and sexual cycle as well as the reproduction (spawning season and areas, relationship to temperature, salinity, plankton, distance from the coast and depth) have been investigated.

The migrations of the Moroccan race have been analysed in relation to the physical and biological environment. A survey of the hydrologic conditions of Moroccan waters, particularly of the seasonal cycle of temperature in the various coastal regions, showed that the entire biology of this fish, especially with regard to the spawning migration, depends on hydrological factors. Migrations are shown to be determined more by variations in water temperature than by the search for food, as has been proved by a comparison of the quantitative distribution of plankton and the concentration of sardines along the coast.

Ocean currents also play an important role in these migrations.

Diurnal and nocturnal differences in the behaviour of sardines and the concentration and dispersal of schools have been analysed on the basis of the echosounders' traces.

Quantitative data (fishery statistics up to 1965) give an indication of the relative share of the sardine in Moroccan fisheries.

No. 2
Fishes
(F)

Notes on the benthic fish population
from Cape Spartel to Cape Cantin

by

J. Collignon
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Following a short review of the physico-chemical conditions of the benthic region in question, the author analyses the demersal fish population of the northern part of

^{1/} Under the code number follows the section and the language of the contribution
(F - French, E - English).

the Atlantic shelf of Morocco from three points of view: 1. Total production, as shown in the fishing statistics; 2. Definition of the population units in relation to the depth and the nature of the sea floor, and 3. Vertical distribution of the important species.

From a biogenic point of view the author arrives at the hypothetical conclusion that after a period of intensive overfishing this region has reached an equilibrium distinctly inferior to the potential productivity.

No. 3
All sections
(F)

Bibliographic review

by

Cl. Maurin and Y. Aldebert
Laboratoire de l'I.S.T.P.M., Sète (Hérault)

The authors give a list of bibliographic references concerning the living resources of the West African shelf region. The references are arranged by sections as follows: I. Faunistics; II. Biology and ecology; III. Tagging; IV. Studies on environmental conditions; V. Fishing charts, and VI. Fisheries.

No. 4
General
Faunistics
(F)

Faunistic inventory of the principal fish species
abundant on the North West African coasts

by

Cl. Maurin and M. Bonnet
Laboratoire de l'I.S.T.P.M.,
Sète (Hérault)

and

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In November and December 1962 the vessel "Thalassa" carried out 63 trawls in the Atlantic region between the bank of La Concepcion (25° 50'N - 12° 40'W) and Tamxat (17° 20'N), and from the coast to depths of 800 m. 264 species of fish were captured, a list of which is given together with the corresponding localities and the maximum depths of the trawls. For the identification of species, Berg's classification, modified by Bertin and Arambourg (1958) was followed.

No. 5
General
faunistics
(F)

Algae fished by the "Thalassa" during a cruise off the
coasts of Mauritania and Spanish Sahara

by

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Faculté des Sciences de Montpellier

A list is given of algae fished in three trawl hauls conducted respectively off Cape Bojador, Villa Cisneros and Cape Timiris. The specimens concerned belong to the Chlorophycophytes, to the Pheophycophytes and to the Rhodophycophytes. Despite the paucity of the specimens collected, the preponderance of the Pheophyceae was noted.

From the bio-geographic standpoint, these algae derive from quite different domains - south Atlantic, Atlantic-mediterranean and tropical Flora. Population differences may be noted between the various stations but the data are still too fragmentary to warrant conclusions concerning the floristics of this region.

No. 6
General
faunistics
(F)

Nature and ecology of trawl fishing grounds
off the coasts of North West Africa

by

Cl. Maurin
Laboratoire de l'I.S.T.P.M., Sète (Hérault)

The author describes the fishing grounds off the North West African coasts suitable for trawling from Arzila (Morocco) to Tamxat (Mauritania). Observations are based on 35 hauls made in the Agadir area in 1952 and 1953, six hauls from the "President Theodore Tissier" in 1959, and 63 hauls from the "Thalassa" in 1962. The different depth levels surveyed over the continental shelf and associated slope are studied, geographic sector by geographic sector - north Morocco, south Morocco, and Concepción bank; Rio de Oro, from Cape Bojador to Villa Cisneros and from Villa Cisneros to Cape Blanc; Arguin bank, and Mauritania, from Cape Timiris to Tamxat.

No. 7
Crustacea and
mollusca
(F)

Crustacea caught by the "Thalassa" in 1962

by

Cl. Maurin
Laboratoire de l'I.S.T.P.M., Sète (Hérault)

The catches of crustacea made by the "Thalassa" in 1962 are described in relation to fishing depth and geographic sector.

Data on yields are listed for the commercial species, in particular the penaeids Aristeus, Aristeomorpha, Plesiopenaeus and for the macrurids Nephrops norvegicus and Palinurus mauritanicus. Conclusions are drawn on ecological and zoogeographical aspects of the crustacean fauna in the region.

No. 8
Crustacea and
mollusca
(F)

Cephalopod exploitation potentialities off the coasts
of Rio de Oro and Mauritania

by

M. Bonnet
Laboratoire de l'I.S.T.P.M., Sète (Hérault)

From Cape Garnet to Cape Timiris, cephalopod trawling offers excellent commercial yields. Analysis of the trawl catches made by the "Thalassa" in this area in 1962 provides evidence on which to evaluate yields, with a species and fishing-ground breakdown, and to determine the relative importance of cephalopods as compared with the total production of fish and crustacea.

No. 9
Fishes
(F)

Geographic and bathymetric distribution of
Helicolenus dactylopterus (Delaroche) and other
Scorpaenids caught by the "Thalassa" off Rio de Oro and Mauritania

by

J. Duclerc
Laboratoire de l'I.S.T.P.M., Sète (Hérault)

Specimens of eleven species of the Scorpaena, Trachyscorpia, Helicolenus, Pontinus, and Setarches genera were caught by the "Thalassa" off Rio de Oro and Mauritania.

Their geographic and bathymetric distribution brings out the ecological barrier constituted by the Cape Blanc region for continental-shelf species. In that same region the southern limit of extension of the Atlantic-mediterranean species, in the strict sense of that term, and the northern limit of tropical African or Guinean species are located.

The ecological barrier is no longer felt where bathyal species, in particular Helicolenus dactylopterus, are concerned, the area of distribution of the latter being far more extensive due to the fact that environmental conditions at great depths are more uniform and attenuate the effects of latitude.

No. 10
Fishes
(F)

Bathymetric and geographic distribution of
flat fishes caught by the "Thalassa" in 1962 off Rio de Oro
and in Mauritania

by

Y. Aldebert
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The flat fishes are represented in the trawl catches made by the "Thalassa" in November and December 1962 off the North West African coast by 22 species belonging to four families.

The bathymetric and geographic distribution of the latter brings to light faunistic differences between the northern and southern parts of the area surveyed.

There are still to be found, off Rio de Oro, Atlantic-mediterranean species no longer encountered along the coasts of Mauritania. Conversely, certain tropical forms are more or less abundant along the coast of Mauritania though they are unlikely to be encountered north of Cape Blanc.

No. 11
Fishes
(F)

Bio-ecological observations on Sparidae
off Rio de Oro and Mauritania

by

M. Bonnet
Laboratoire de l'I.S.T.P.M., Sète (Hérault)

The research vessel of the Institut des Pêches maritimes "Thalassa" caught 18 species of Sparidae between Cape Juby and Tamxat. Observations made in each case warrant conclusions on three different aspects:

faunistic (geographic limits of northern species and those with tropical affinities);

biological (bathymetrics);

fisheries (yields as affected by depths and latitudes).

No. 12 Biometrical data on Scomber colias of the North West African coasts
Fishes
(F)

by

M. Bonnet
Laboratoire de l'I.S.T.P.M., Sète (Hérault)

The measurements and meristic data considered in this paper refer to a batch of Scomber colias caught in the course of several trawl hauls between Cape Bojador and Tamxat. Most of the meristic characters analysed vary with age. Possibly some of them are also influenced by environmental conditions, so that their comparison, in turn, with samples caught in other sectors will provide evidence of heterogeneity of the Atlantic stock. This was the purpose of the present study.

No. 13 Immuno-haematological techniques and their
Fishes potential applications in the study of fishes
(F) of the North West African coast

by

S. Landrein and P. Pichot
Laboratoire de l'I.S.T.P.M., Sète (Hérault)

The use of serological and immunological methods can make an important contribution to the better understanding of species, sub-species or races. Among blood characteristics of potential aid in taxonomy are:

- a) blood groups, natural serum antibodies and red-cell antigens; and
- b) the various protein constituents of serum: these can be identified by immunological or electrophoretic (notably cellulose acetate and polyacrylamid gel) techniques.

One of the purposes of this paper is to help in making a choice between the methods available. Only a few technological aspects of the question are touched upon.

No. 14 Project for statistical classification of species
Statistics covered by the Demersal Fish (Southern) Committee,
and stock Pelagic Fish (Southern) Committee and the Anodromous
assessment and Catadromous Fish Committee
(F)

by

F. Lozano Cabo
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The extension of the area of ICES to all the euro-african Atlantic, and as a result of this, the establishment of new Southern Fish Committees have brought about the need for revising the system of fishery statistics in this area.

The number of species found in the Gulf of Gascony, and off the coasts of Spain, Portugal, Morocco, the Spanish Sahara, Mauritania and the Canary Islands practically reaches the figure of 700, of which no less than 300 are edible and 160 of economic importance.

Hence there is a need for grouping these species by genera and possibly, families in order to minimize the number of statistical units.

The paper gives general comments on species, family by family, and suggests the statistical areas to be established. The species to be classified for statistical purposes are recorded in a table with the scientific, Spanish and French names deemed acceptable for the proposed statistical groupings.

No. 15
Statistics
and stock
assessment
(E/F)

West Africa: fishing fleet statistics

(Also issued as "FAO Fisheries Circular" No. 184)

by

Current Statistics and Economic Data Section
Fishery Economics and Products Division
FAO Department of Fisheries

This Circular comprises three tables covering the three regions of West Africa: Western, landlocked; Western, coastal; Northwestern. Each table provides available data on the fishing fleets by countries within the region, for the years 1958, and 1962 to 1966.

No. 16
Statistics
and stock
assessment
(E/F)

Eastern-Central Atlantic: maps for fishery
statistical purposes

(Also issued as "FAO Fisheries Circular" No. 182)

by

Current Statistics and Economic Data Section
Fishery Economics and Products Division
FAO Department of Fisheries

This Circular consists of one map for the Eastern-Central Atlantic area, with a grid system by 5° rectangles, two maps giving details of the "Estuary of the Congo River" and the "Straits of Gibraltar", and three maps of fishing area breakdowns for the Eastern-Central Atlantic area used by France, Italy and Portugal.

No. 17
Fishing and
utilization
of the catch/
Fishes
(E)

The characteristics of the fishing ground of Cape
Timiris at the coast of West Africa

by

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Exploratory fishing operations were carried out from 8 November 1965 to 15 January 1966 in the area of Cape Timiris (between 18°50'N and 19°20'N), at a depth of 25 to 60 m. Sea temperatures showed a declining tendency during this period.

The most abundant fish species was anchovy (Engraulis encrasicolus) which could, however, only be used for fish meal. It was of great significance, however, as the main food for concentrations of Lichia vadigo and "blue fish" (Pomatomus saltatrix). These two species were the most valuable ones in the catches, making up to 45% and 10% of the total, respectively. The keeping quality of the two species under conditions aboard trawlers of the B-23 and B-18 types is discussed. The feeding of the species took place mainly during the night, when the shoals occurred pelagically. The concentrations were considered to be post-spawning, feeding ones.

A 110 feet nylon-trawl was used, first in the deeper parts of the area, and later on - following the migration of the shoals - in more shallow waters, until the shoals disappeared early in January. The highest average yield of L. vadigo was obtained in late November, with 916 kg per 1 hour trawling.

Characteristics of echo-traces are mentioned, and the possible influence of water temperature and cloudiness on the catches is discussed.

No. 18 Some remarks on the hydrological conditions
Physical of the waters of the NW African Shelf in the
Oceanography months from June till August 1967
(E)

by

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Intensive investigations were carried out from June to August 1967 between Cap Blanc and Monrovia, including records of a) temperature, b) salinity, c) oxygenation, and d) content of phosphate.

The results show that the region in question may, on the basis of hydrological conditions, be divided into the following areas:

- a) north of Cape Blanc (21°53'N to 20°50'N)
- b) from Cape Timiris to 17°N
- c) off the mouth of the Senegal river
- d) off the mouth of the Gambia river, and
- e) the coastal region of Sierra Leone and Liberia.

The characteristics of each of these regions for the said months of the year are described.

No. 19 Cephalopods as by-catch in trawl catches from the fishing
Crustacea grounds extending from Rio de Oro to Cape Timiris in 1966
and mollusca
(E)

by

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On the fishing grounds from Rio de Oro to Cape Timiris three species of cephalopods were found, viz. Sepia officinalis, Loligo vulgaris and Octopus vulgaris. Sepia officinalis made up the highest percentage in the by-catch of cephalopods, namely 8.1%. The other two species, Loligo vulgaris and Octopus vulgaris, made up 3.9%. Thus in total these cephalopods made up 12% of the catch, expressed by weight.

Sepia officinalis was characterized by the largest range of length-groups (11-12 to 141-142 cm). The maximum weight of a specimen of this species was 9.550 g.

Some relation was observed between the depth of the fishing ground and the size of the cephalopods, showing an increase in weight and size with increasing depth. The largest cephalopods were captured at a depth of 70-130 m on the fishing ground of Cape Blanc.

Cephalopods occurred on the sandy and sandy-muddy bottoms and the character of the bottom sediments is of some importance for their occurrence on a particular fishing ground.

No. 20

Fishing and
utilization
of the catch
(E)

Trawl nets used by Polish trawlers on fishing grounds
of the West African Shelf

by

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and

W. Burawa
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The authors describe the Polish 33/37 and 38/37 trawls as used by freezer trawlers of the B-23 and B-18 types on the West African fishing grounds, give details of rigging and operation and provide figures for catches made by bottom trawls as well as by mid-water trawls.

They conclude that:

1. To increase the fishing efficiency of mid-water trawls, control apparatus (for example transducers) are unavoidable. Catches with mid-water trawls but without a control apparatus are possible only in cases of dense concentrations of fish in the pelagic zone, which on the African fishing grounds very often take place at night. Consequently, there is a need to use bottom trawls in the daytime and mid-water trawls at night. Passing over from bottom trawls to mid-water trawls on stern trawlers B-23 and B-18 takes 23-25 minutes (employing the same flat otter boards and bridles as in the case of bottom trawls).
2. Trawling of vertically moving shoals give no positive results.
3. Fish caught by mid-water trawls were in a better condition and with no slime content.

Fishing at the bottom in the daytime and in mid-water at night enables a more rhythmic yielding of fish, which is very important when freezer plants are being used. The good results of the experimental mid-water trawl catches in 1966 on the African fishing grounds give striking evidence that there is a need for a wider use of that gear, as a supplementary means of fishing also in other regions worked by Polish vessels.

No. 21

Plankton
(F)

Present lines of research on plankton in the waters
of the North West African Shelf

by

Krystyna Wiktor
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The author discusses the development of plankton research, states the present status of the knowledge of the plankton of the area and identifies certain trends in the research now going on. While most of the earlier results were due to visits by expeditions from several countries, a more significant part is now played by co-operative investigations and by research carried out by laboratories situated in the area.

The species composition of the plankton is now relatively well known, although there are still great differences between the better known groups (chaetognathes and partly copepods) and the lesser known ones (fish eggs and larvae, decapod larvae). Identification sheets like the ones in use for the North Atlantic would be very useful at this stage.

Qualitative, as well as quantitative studies, especially on the biology of the species and on productivity are under way, and some main trends can already be ascertained. These and other studies show the area between Gibraltar and Dakar to

be the most productive one, in a somewhat sharp contrast to the more southerly waters and the Gulf of Guinea. This productivity is mainly due to upwelling, and the main period of production is from November to May.

The relationship between phytoplankton and zooplankton in the area raises interesting problems which are being intensively studied. Experimental work, much to be desired, has however hardly commenced.

No. 22
Fishes
(E)

On the occurrence of spawning concentrations of some
fish species over the North West African Shelf in the summer
of 1967

by

J. Rażniewski
Morski Instytut Rybacki, Gdynia

The author presents observations on spawning areas and spawning periods of some important food fishes in the area. The observations were made between 12 June and 5 August 1967.

Caranx rhonchus occurs in catches throughout the year, but only in summer it is gathering in dense, pre-spawning concentrations. Spawning took place from the end of July, and the peak was probably reached in August. The main spawning area seems to be located between 19°N and 20°30'N, at depths between 25 and 35 m.

Lichia vadigo also occurs somewhat sporadically in the catches throughout the year, but gathers in pre-spawning shoals during the summer. Spawning starts towards the end of July and most of it takes place in August. The main concentrations were found between 19°N and 21°N at depths between 25 and 90 m. The shoals were intensively feeding on Engraulis encrasicolus, and included some immature specimens.

Pre-spawning concentrations of Vomer setapinnis and Hynn timeriensis were observed in June and July, the latter chiefly in the southern part of the area investigated.

Other species of commercial importance observed were Mycropteryx chrysurus, Dentex filamentosus, Pagrus ehrenbergii, Diagramma mediterraneum, Sphyrna tiburo and Trachurus trachurus.

No. 23
General
faunistics
(E)

The ecological distribution and primary productivity
of marine benthic algae of Lanzarote in the Eastern Canaries

by

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Phytosociological and production studies of benthic marine algae were undertaken employing SCUBA diving techniques. Conventional ecological and specially developed photogrammetric survey methods were used in a quantitative examination of several algal communities. The commonest such community of the island benthos is Padina pavonia - Halopteris scoparia, which is found at most localities, especially in sheltered areas. It is replaced by Cystoseira abies-marina in regions of heavy wave action. Caulerpa prolifera and the angiosperm Zostera marina dominate in sand habitats, C. prolifera being found down to depths of over 40 metres. Although the total number of species is relatively high, figures for standing crop are low compared to those recorded for northern waters (below 100 g dry weight/m² in deep-water Caulerpa meadows to 1500 g dry weight/m² in Cystoseira areas).

Employing the light-dark bottle technique, primary production estimations were made for dominant algal species using C^{14} incorporation and oxygen production methods of assay. Expressed on a dry weight basis, values for production of organic matter appear to be relatively high (mean value about 14 mg glucose/g dry weight alga/day), but because of the low standing crop the final estimates of production per m^2 are low.

No. 24 Distribution of marine mollusca of Lanzarote in relation
General to benthic algae and an attempted correlation with the
faunistics digestive capabilities of these mollusca
(E)

by

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With the use of SCUBA diving techniques, a survey has been made of the distribution of molluscs associated with the following benthic algae:

Caulerpa prolifera
Caulerpa racemosa
Caulerpa webbiana
Codium bursa
Codium tomentosum
Halimeda tuna
Cystoseira abies-marina

Padina pavonia
Pocockiella variegata
Digenia simplex
Galaxaura squalida
Heterosiphonia sp.
Liagora spp.
Pterocladia pinnata

and the angiosperm Zostera marina. Four mollusc species were found to be particularly common on these algae, viz. Tricolia pulla, Rissoa costulata, Bittium reticulatum and Calliostoma exasperata. Codium bursa and Digenia simplex plants were occupied by large numbers of Arca lactea and the latter also carried an abundance of Rissoa glabra. Zostera marina was almost completely free of molluscs.

Samples of the mollusc species collected from algae were extracted and the activity of the digestive enzymes α -amylase, laminarinase, agarase, cellulase, acid phosphatase and acid esterase determined. Similarity in the enzymic potential of Tricolia pulla and Rissoa costulata concurred with similarity in their distribution. The same appeared to be the case for Bittium reticulatum and Calliostoma exasperata. Extracts of other mollusc species from different habitats were also studied.

No. 25 Oceanographic data from the southern area
Physical in the ICES Service Hydrographique
oceanography
(E)

by

J. Smed
International Council for the Exploration of the Sea
Charlottenlund Slot

After some general remarks about the data collections in the Service Hydrographique, the oceanographic data centre of the ICES region, details are given on the amount of data from the Atlantic area 0° - 40° N, east of 60° W, worked in the period 1901-1956 and available in the centre. The number of stations worked in each 5° square of the area is recorded, the numbers of serial and surface stations being indicated separately. An appendix records the sources of the data.

No. 26
Plankton
(F)

New contribution to the study of copepods
of the Cape Verde Archipelago

by

Inácia de Paiva
Centro de Biologia Piscatoria, Lisboa

The author reports on planktonic copepods from 39 horizontal surface hauls, made between 18 April and 11 July 1959 at the Cape Verde Islands.

40 species were recorded, 14 of them reported for the first time from the area. 30 of the species are also found at the North West African Shelf between Morocco and Liberia.

Notes are given on the ecology of some of the species.

No. 27
Plankton
(F)

On the Siphonophora calycophora of the Cape Verde Islands

by

Teresa S. Neto
Junta de Investigações do Ultramar
Centro de Biologia Aquática Tropical, Lisboa

The author reports on siphonophores from 44 samples collected between 18 April and 11 July 1959 at the Cape Verde Islands.

19 species were recorded, 4 of these for the first time from the area. The most abundant ones were Chelophyes appendiculata, which was found in all samples but two, and Eudoxoides spiralis, which was found in 22 samples.

The richness of the fauna is attributed to the oceanic environment with rather warm waters (21 to 24°C) of high salinity (35.73 o/oo was the lowest salinity recorded).

No. 28
Fishes
(F)

Summary of biological and ecological studies
on Bluefin Tuna, *Thunnus thynnus*; Little Tuna, *Euthynnus*
alletteratus; Atlantic Bonito, *Sarda sarda*; and Frigate
Mackerel, *Auxis thazard*, caught by Spanish madragues

by

J. Rodríguez-Roda
Laboratorio de Investigaciones Pesqueras, Cádiz

The author gives a summary of biological studies of *Thunnus thynnus*, *Euthynnus alletteratus*, *Sarda sarda* and *Auxis thazard*, caught in the four remaining Spanish madragues during recent years.

Some information is given on the migration pattern of these species and data are presented on temperature and salinity at the site of the Barbate gear.

During the last 36 years, catches seem to have fluctuated with a cycle of 6 to 7 years.

Size, weight and growth curves are shown for the different species, especially

for Thunnus thynnus, and the condition factor is also discussed for that species.

Spawning time and age at first maturity for the different species are reported as far as they have been ascertained.

No. 29 Results of tagging experiments on Bluefin Tuna, Thunnus thynnus (L.),
Fishes in the Gulf of Cadiz (Spain)
(F)

by

J. Rodríguez-Roda
Laboratorio de Investigaciones Pesqueras, Cádiz

The author reports preliminary results of 312 taggings of Thunnus thynnus, undertaken at the "madragues" of Barbate and Sancti-Petri (Gulf of Cadiz) during the years 1960 to 1967.

So far there have been 19 recaptures (and two unconfirmed ones from Libya), four of them from the Mediterranean, one from the coast of Morocco between Mogador and Agadir, and the rest from the vicinity of the tagging places.

No. 30 Summary of our hematological investigations on Bluefin Tuna,
Fishes (Thunnus thynnus (L.)), of the coasts of Southern Spain
(F)

by

Manuel Gutierrez
Laboratorio de Investigaciones Pesqueras, Cádiz

The paper summarizes investigations on the blood of Thunnus thynnus, reported in greater detail elsewhere (Investigación Pesquera, 31(1), pp.53-90, 137-143 and 161-164).

No. 31 Summary of studies on the seasonal variation in the chemical
Crustacea and composition of some molluscs and crustaceans of the
Mollusca Atlantic coasts of Spain and Morocco
(F)

by

R. Establier
Laboratorio de Investigaciones Pesqueras, Cádiz

The author presents the results of biochemical analyses, undertaken in recent years, of the shrimps Parapenaeus longirostris and Plesiopenaeus edwardsianus and of the oyster Crassostrea angulata.

The samples of P. longirostris were taken from the Bay of Cadiz and from the Atlantic coast of Morocco, while those of P. edwardsianus came only from the coast of Morocco. The oyster was sampled in the Bay of Cadiz.

Fluctuations in the chemical composition of these species throughout the year are shown in tables and discussed in relation to sexual cycles and geographical distribution. Differences in the chemical composition of shrimps from the two localities are tentatively related to differences in keeping quality.

No. 32
Fishes
(F)

Summary of chemical investigations on the Bluefin Tuna,
Thunnus thynnus (L.), from the Gulf of Cadiz, Spain

by

R. Establier
Laboratorio de Investigaciones Pesqueras, Cádiz

The paper summarizes the results of chemical and biochemical studies on Thunnus thynnus, caught in madragues in the Bay of Cadiz.

Samples from three different parts of the muscles, from the liver and from the pyloric coeca were analysed, and the fat content, as well as proteins, ashes and water were determined. An analysis was also made of the vitamin A content of the pyloric coeca, and oils obtained from specimens of the species were compared with sardine oil.

The results are presented in tables and the differences found between tunas migrating to the spawning places and those returning from them are discussed.

No. 33
Physical
oceanography
(E)

Some observations on upwelling in the area of Cape Blanc -
June/August 1963

by

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The author presents, in the form of diagrams with comments, observations on upwelling along a sector at 20°47'N, from cruises undertaken in June, July and August 1963.

No. 34
Crustacea
and mollusca
(E)

Observations on the occurrence of Cephalopoda
in the waters of the North West African Shelf,
with particular regard to Loligo vulgaris (Lamarck)

by

J. Porebski
Morski Instytut Rybacki, Gdynia

Loligo vulgaris and sepias were most often captured at depths of 20 to 80 m, and their size depended upon the depth as well as upon the geographical location of the fishing ground. Ommastrephidae were found in waters deeper than 90 m. However, the relatively small number of hauls in these waters and the lack of hauls from waters deeper than 300 m did not allow more detailed data on their distribution.

It is noteworthy that there were hardly any Cephalopods in the hauls taken from depths of 20 to 80 m in the region of the Shelf waters south of 17°10'N.

No. 35
Fishing and
utilization
of the catch
(E)

Fishing yield and species composition of trawl catches
of m/t 'Ramada' in the fishing grounds on the Shelf
off Mauritania and Senegal in 1967

by

A. Klimaj
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The hauls carried out during the spawning period in the region extending from Cape Bojador to the Cayar Channel in the months of April, May and June gave good yields at depths from 65 to 200 m.

The average yield per hour trawling fluctuated in that period for the freezer-trawler from 2.4 to 3.9 tons per hour. The mean yield was high, amounting to 30 tons per day. In the trawl catches 50 to 60 fish species occur, belonging to several families.

In shallower waters, down to a depth of 120 m, fish belonging to Carangidae, Sparidae and Scombridae made up to 70-90% of the catch. On fishing grounds of depths from 130 to 200 m, Merluccius merluccius made up about 12% of the catch.

Among Carangidae the most important species in the commercial trawl catches are: Trachurus trachurus, Trachurus picturatus and Decapterus punctatus.

Among Sparidae predominant in the trawl catches were: Pagrus ehrenbergii, Dentex macrophthalmus and Dentex filiosus. The latter two occur in larger amounts in deeper waters at 130-200 m depths.

Scomber colias, occurring in waters of medium depth (from 60 to 105 m), is of great importance in trawl catches in March, April and May on the fishing grounds off Senegal. In June and July the catches of Scomber colias declined, giving lower yields. In these months the spawning of Parapristipoma mediterraneum takes place, and the catches of this species increased rapidly in shallow waters (15 to 30 m). On the deeper fishing grounds (90-180 m) of that region, large concentrations of Trichiurus lepturus are found in June and July. This species may reach 10-15% of the total catch and is, therefore, important to fish processing.

No. 36
Fishes
(F)

Zoogeographical characteristics of the ichthyofauna
of the coasts of North West Africa (Canary Islands,
Morocco, Spanish Sahara, Mauritania, etc.)

by

F. Lozano Cabo
Instituto Español de Oceanografía, Madrid

The paper opens with general considerations on the uniform character of the marine environment and the discontinuous character of the land environment. This is followed by a list of the Euro-African zoogeographic regions, provinces and districts, both terrestrial and marine, special attention being given to the classification of the latter, as proposed by Forbes and still in use, with references to the Lusitanian, Mediterranean and Mauritanian provinces. Mention is also made of the periodic shifts in the frontiers between these provinces as a result of changes in seasonal climatic regime.

A detailed analysis follows of the Ethiopian or tropical fauna, mainly the Mauritanian, with special reference to its characteristic or accidental species and to its frequently alleged condition of being a transition fauna.

The ecological characteristics of the Mauritanian fauna are pointed out. Of the 371 known species, 62.26% are benthic: 20.11% pelagic and 17.32% abyssal.

In the case of the Canary Islands, the palearctic influence (83.69% of the species) is stronger than in Mauritanian waters (16.30%), despite the greater proximity of Africa, a circumstance which is explained only by differences in temperature and the existence of oceanic troughs that separate them. Where ecological characteristics are concerned, there are only 47% coastal benthic species (absence of continental shelf, explained by the volcanic origin of the island), 28.07% abyssal and 24.01% pelagic. There is a notable American faunistic influence in the fish population of these islands.

No. 37 Scientific research towards the knowledge and exploitation of
Fishing and the Canary/African fishes. Fishery installations.
utilization General and detailed information on the Spanish landings
of the catch

(F)

by

F. Lozano Cabo
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An account is given of the oceanographic surveys of the Canary/African region which were initiated in 1873 by the research vessel "Challenger". This account includes the surveys made by non-Spanish vessels, those by vessels operated on a continuing basis by the marine laboratories of the African coastal countries and the work conducted in this field by Spain. The latter commenced in 1928 with the establishment of the Oceanographic Laboratory at Las Palmas on the Great Canary Island and was continued by 15 research cruises, the latest events being the creation of the laboratory at Santa Cruz de Tenerife. This laboratory has also conducted some cruises.

The main section of the paper considers the attempts by European countries in the past to set up factories to exploit the fisheries off the Sahara-Mauritanian coasts, beginning in 1685 with the creation of the Compagnie de Sénégal, under a patent granted by Louis XIV of France. The list continues until 1905, after which, and where Spain is concerned, only the Canary islanders have carried on the tradition - until very recent years, when other companies besides those based on the Canary Islands began to exploit these fishing grounds again.

No. 38 Fishing maps for waters of the Spanish Sahara

Fishing and
utilization
of the catch

by

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Instituto Español de Oceanografía, Madrid

The paper reproduces in black and white and describes the five fishing maps published by the Instituto Español de Oceanografía covering the region between the latitudes of Cape Ghir and of Cape Blanc. This region was surveyed in five cruises by the hydrographic and oceanographic vessels "Xauen", "Malaspina" and "Tofino" in 1946, 1947, 1948, 1950 and 1952. The surveys were supplemented, where faunistics and fisheries are concerned, by three further cruises of the "Abrego" (1941), the "Cierzo" (1942) and "Asia" and "Atiza" (1947).

The maps are basically bathylithological, accompanied by faunistic and fishery data, some on the maps themselves and the rest in the associated text.

No. 39
Fishes
(F)

List of fishes from the coastal areas of
the Continental Shelf of Morocco, Spanish Sahara
and Mauritania collected during the Spanish faunistic surveys,
with notes on zoo-geography

by

F. Lozano Cabo
Instituto Español de Oceanografía, Madrid

The author first gives a list of faunistic survey cruises along the North West coast of Africa carried out by Spanish research workers - chiefly Lozano y Rey, Navarro Martín, Navaz y Sanz and Lozano Cabo.

The surveys concerned only coastal species found in waters less than 100 m deep.

A list of 200 species found is given, together with indications, as far as possible, of the localities of capture and of data on the relative abundance of the species.

No. 40
Fishes
(F)

Present state of knowledge of the biology
of tuna and related species on the Continental Shelf
of Atlantic Morocco

by

F. Lozano Cabo
Instituto Español de Oceanografía, Madrid

The paper first lists the tuna and related species as well as other scombroids caught on the continental shelf of Atlantic Morocco.

This is followed by the results of madrague-fishing in Morocco, in 1955 supplemented by similar data from the Gulf of Cadiz and the Straits of Gibraltar.

The research on this question concerns chiefly:

1. The physico-chemical conditions of environment (temperature, salinity, dissolved oxygen and transparency of water);
2. Correlations between presence or absence, and abundance, of tuna and temperature, salinity and water transparency, and also height of tides;
3. Process of sexual maturation;
4. Biometrics (biometric indices, size and weight, relative growth and age);
5. Catch statistics, including seasonal occurrence and fisheries forecasting.

No. 41
General
faunistics
(F)

Invertebrates collected by the
Instituto Espanol de Oceanografía during cruises along the
Continental Shelf of Spanish Sahara

by

R. Robles Pariente
(with an appendix by F. Lozano Cabo)
Instituto Espanol de Oceanografía, Madrid

Account is given of the cruises conducted by the Instituto Español de Oceanografía along the continental shelf of North West Africa. Mr. Robles' paper covers the cruises of the "Abrego" (1940), the "Cierzo" (1941) and the "Malaspina" and "Tofino" (1946, 1947, 1948, 1950 and 1952).

Mr. Lozano Cabo's appendix covers the cruises carried out by Lozano y Rey off the coasts of Spanish Sahara and Ifni (1934 and 1935) and the cruises of the "Asia" and the "Atiza" in 1947, and includes data provided by Lozano Cabo and Lozano y Rey from the madragues in Atlantic Morocco in 1955.

Robles Pariente cites 3 species of sponges, 7 of coelenterates, 12 of echinoderms, 25 of crustaceans and 20 of molluscs.

Lozano Cabo lists 17 crustaceans, 20 molluscs, 4 coelenterates and 2 echinoderms.

The papers emphasize how small these numbers are - due no doubt to the fact that the main purpose of these cruises was ichthyological surveys.

No. 42
Physical
oceanography
(F)

The hydrological cycle in the Bay of Lévrier

by

G. Tixérant
Laboratoire des Pêches Maritimes, Port-Etienne, Mauritanie

The observations carried out in this region throw light upon the following aspects:

The inland waters follow the fluctuations observed at the entrance of the bay with a time-lag of several days. High salinities are sometimes caused by the action of coastal waters being displaced by waters of higher density at the entrance of the bay. However, during the first 3 months of the year the waters at the entrance of the bay are always of the mixed type "CS" (C = Central Atlantic waters; S = intermediate waters from depth "S" defined by Jacobsen 1929).

It is apparent that the earliest year of observations in the bay (1953) showed a more sustained inflow of salty water than is the case at the present time.

While these waters were present in the first and third quarters of 1953, their impact was also rather strong in 1954 and 1955; i.e. during three consecutive years. Thereafter strong CS influences appeared during only one year out of two: 1957 - 1959 - 1961 - 1963 (March) and 1965.

Is this an indication of a vast scale balancing affecting the margins of the body of the Central Atlantic waters? For the time being, this is the only hypothesis that suggests itself.

No. 43 Experimental trawling from 1963 to 1965 in the vicinity of
Fishing and Cape Blanc
utilization
of the catch
(F) by

G. Tixérant
Laboratoire des Pêches Maritimes, Port-Etienne, Mauritanie

The main facts emerging from this study and the implications for future orientation of research are the following:

Principal features of the fauna

- a) Two types of species are found in trawl catches from the Bay of Lévrier: warm water species and temperate water species. This is not surprising because of the geographic location of the Bay of Lévrier, where the waters are more often temperate than really warm.
- b) The fauna of the bay shows several features:
 - i) predominance of "trash fish";
 - ii) predominance of species suitable for salt curing (at present);
 - iii) abundance of young fish;
 - iv) low quantities of cephalopods.
- c) There are important yearly fluctuations in composition of the fauna.

Future guidelines for research

Studies on potential commercial stocks should be undertaken separately for different fishing grounds, covering the most abundant species, as soon as fish landings are regularly available.

In the light of industrial requirements, the following species seem worthwhile studying:

- a) Among the fish, the species to be considered of special interest to the industry, are: dogfish, sparids and flatfish for freezing; croakers for salt curing.
- b) Cephalopod species which might be exploited by the industry are found in this region and should be studied on all fishing grounds.

Studies should also be undertaken to determine the potential yield of the trawling grounds in terms of marketable shrimps at the southern part of the Arguin bank. If a certain species is found on several fishing grounds it should be given priority.

This program may appear difficult to carry out but this is a question of availability of adequate means, particularly competent staff.

In the course of the next years the fisheries laboratory will work in close contact with the industry.

No. 44 Portuguese trawl fisheries in ICES Statistical Area XI
Fishing and (Mauritanian coasts) 1955-1964
utilization
of the catch/
Statistics and
stock assessment
(F) Rui Monteiro and M. Lima Dias
 Instituto de Biologia Maritima, Lisboa

This paper summarizes statistics relating to Portuguese trawl fisheries in ICES Statistical Area XI for 1955-64. It continues the work done by A. Ramalho for the period 1934-54 (NOTAS E ESTUDOS DO INSTITUTO DE BIOLOGIA MARITIMA, No. 9, January 1956) and in addition considers the economic aspects.

A pattern of decreasing yields during the period between 1955 and 1963 was found, the hake showing the most marked decline of all. Despite higher landings for this species in 1964, the size known as "pescada" (over 45 cm of length) was virtually absent from that year's catches which consisted for the most part of "marmota" (25-44 cm specimens). From this it may be assumed that the fish stocks in the ICES Area XI seem to be somewhat limited, and ICES should accordingly promote international trawling surveys in that area mainly for the purpose of estimating the abundance of fish in general and of hake in particular, and determine the most effective way of improving or at least conserving those stocks.

No. 45 Review of our knowledge of the presence of Bluefin Tuna
Fishes along the Atlantic coast of Morocco.
(F) Observations and comments

by

H. Aloncle
Institut des Pêches Maritimes du Maroc, Casablanca

The author spent seven years on the Atlantic coast of Morocco and took part in an experimental tuna fishing campaign covering the entire area of the waters off Morocco and the Iberian Peninsula. He gives an overall picture of the migratory movements of "red tunny" in these regions.

Commenting on the presence of large Bluefin specimens in summer between Safi and Agadir, the author offers two hypotheses on the origin of these fish: either they are tuna on the return migration, which have branched off southward instead of going northward after spawning and crossing the Straits of Gibraltar, or they are tuna that have never penetrated into the Mediterranean at all but have spawned in the Bay of Gibraltar and belong to an Atlantic population.

On this second hypothesis, only the large tuna of Mediterranean origin would pass through the Straits and spend the winter in the Atlantic, returning thence to the Mediterranean spawning grounds the following spring.

No. 46 Observations on certain rays of the Atlantic coast
Fishes of Morocco off Casablanca
(F)

by

H. Aloncle
Institut des Pêches Maritimes du Maroc, Casablanca

The author discusses the bathymetric distribution and food regime of the most common rays captured on the continental shelf off Casablanca.

A graph shows the bathymetric distribution and indicates the relative importance of populations. R. clavata is by far the dominant species.

No. 47 Chemical oceanographic observations off the coast of
Physical north-west Africa, with special reference to
oceanography the process of upwelling
(E)

by

P.G.W. Jones and A.R. Folkard
Fisheries Laboratory, Lowestoft

Hydrographic investigations were made off the coast of north-west Africa during June 1965, March 1966 and November 1967. The survey consisted of sections extending from the coast into deep water, and was designed to locate areas of upwelling and to compare the magnitude of this phenomenon at different seasons. Temperature, salinity, oxygen, phosphate, nitrate and silicate were measured.

The first survey was made between Cape Juby and the Gulf of Cintra; north-east trade winds predominated, and active upwelling was encountered on all sections. The second one covered the area between Cape Juby and Cape Blanc; all sections showed evidence of upwelling, although winds were generally lighter than during the previous survey. The third survey (1967) extended from Cape Ghir to Conakry; active upwelling was found between Nouakchott and Cape Blanc under the influence of northerly winds; between the Gulf of Cintra and Cape Ghir upwelling was also evident, although winds were generally light and variable; to the south of Cape Verde upwelling was not encountered.

No. 48 The hydrographic conditions on the African Atlantic
Physical Continental Shelf as measured by RV "Meteor" from February
oceanography to April 1937
(E)

by

G. Tomczak
Deutsches Hydrographisches Institut, Hamburg

Following the "Deutsche Atlantische Expedition 1925-27", the German research and survey vessel "Meteor" in 1937 and 1938 conducted several expeditions into the North Atlantic Ocean. One of these cruises headed in spring 1937 for the sea area off the west African coast between the Canaries and the Cape Verde Islands.

The results of several anchor stations on the shelf are discussed which were derived from hourly serial measurements of temperature, salinity, and density and from measurements at several levels of the current, conducted as far as possible continuously. All stations reveal an extraordinarily strong variability which seems to depend on the wind conditions and on the topography of the shelf. Though the stations lie in the centre of upwelling, sinking water masses are also observed.

From April to June 1968 the new German research vessel "Meteor" will again visit the area of upwelling off the west African coast. During this expedition self-recording instruments will be placed to measure the current, the temperature, and the tides and several anchor stations will be made for continuously measuring physical, chemical, and biological parameters. The programme of this expedition is briefly shown and explained.

No. 49
Plankton
(F)

Report on plankton

by

Marie-Louise Furnestin

Laboratoire de Biologie animale (Plancton), Faculté des Sciences de
Marseille

The report (1) sets forth the present state of knowledge (fauna, ecology, biogeography, etc.) relating to planktonic flora and fauna, with a view to evaluating their role in the economy of this area of the Atlantic, and (2) suggests possible avenues of research on the plankton over the north-west African Continental Shelf.

The inventory of plankton forms is in an advanced stage. There remains the task of surveying the bathyplankton. The Crustacea (Cladocera, Copepoda, Euphausiacea, Amphipoda), in view of their place in plankton as fish food, call for intensive study. Regional surveys should be linked up in order to provide an overall view of populations.

Productivity (phytoplankton) and zooplankton biomass measurements are as yet fragmentary. They are necessary, on the one hand, in order to reveal the geographic and seasonal aspects of marine-life fertility and, on the other, as a means of studying certain of the major fish food species (Copepoda, for example).

Relationships between plankton and hydrology have been demonstrated in several places (contact zones, upwelling zones), though these still need to be studied in detail (a) where phytoplankton is concerned, in its relation with the local physico-chemical environment, (b) for zooplankton forms offering a high nutritional potential, and (c) for indicator organisms.

The relations between plankton and fish need to be analysed:

- (a) in studies on abundance, seasonal cycle, annual or freak variations, locations and conditions governing the concentration of plankton supporting commercially important fish species;
- (b) in research on fishery indicators (whether favourable or adverse); and
- (c) in a study of the interrelations between the ichthyoplankton and the adult fish - location of spawning areas and seasons, appraisal of overall spawning potential and assessment of recruitment, egg mortality, effect of predators on fish larvae, etc.

The report concludes by stating that while the first phase of the survey of the plankton in the waters off north-west Africa, namely that of fundamental planktonology, is practically complete, the second phase, applied planktonology, is scarcely beginning.

The bibliography contains 250 references.

No. 50
Fishing and
utilization
of the catch
(E)

The purse seine and sardine fishery in Ghana
with a note on morpho-biological observations

by

M. Ansa-Emmim
Fishery Research Unit, Tema

Ghana has a long fishing tradition based on the Sardine Fishery. The traditional gear used is the "Ali net". This is operated as a ring-or gill net according to the season and area from a dug-out canoe.

Motor fishing vessels were introduced into the country in January 1946. This was followed by the introduction of the purse seine net in 1959. The vessels and gear are described in the text.

The appearance of S. aurita (Cuv. et Val.) in the surface layers is closely associated with the upwelling of cold water along the coast. The main fishing period is from late June to early October. Appreciable quantities of S. aurita are landed during February-March whenever the small upwelling occurs.

Length frequency data of S. aurita for 1964-66 showed the prominence of the 1961/62 year-class fish. The entry into the fishery of new broods was also observed.

The author is aware of the limitations of the effort data. When detailed commercial statistics for each trip of each vessel are known, a more reliable measure of effort can be computed.

No. 51
Fishes
(F)

The biology and fisheries of large scombroid fishes
off North-West Africa

by

V. Richards and J.P. Wise
BCF Tropical Atlantic Biological Laboratory, Miami

The authors analyse the importance of several scombroid fishes in the catches off North West Africa taking into account some environmental conditions and behaviour patterns of these fishes. The species considered are: Thunnus albacares (Bonaterre), Thunnus obesus (Lowe), Thunnus thynnus (Linnaeus), Thunnus alalunga (Bonaterre), Thunnus albidus Poey, Xiphias gladius Linnaeus and Makaira nigricans Lacépède

No. 52
Plankton
(E)

Investigation on the production in the Mediterranean
sponsored by the Sub-committee of Oceanography, NATO

by

E. Steemann Nielsen
Danmarks Farmaceutiske Højskole, Copenhagen

In 1962 the late professor U. D'Ancona, Italy, asked the Sub-committee of Oceanography, NATO, for grants to study the marine productivity in the areas where Sardina pilchardus is found. During the last three years such investigations have been made by 9 different groups scattered over the whole Mediterranean coast and the western side of Europe as far as Britain.

With one exception all groups have worked in areas without any influence of sewage. The investigations have been made as far out from the coast as circumstances

have allowed. The material covering primary production will be published during 1968.

A really low annual rate of primary production - about 30 g C/m^2 - has only been found in the most eastern part of the Mediterranean - i.e. off the coast of Israel. The highest annual rate in the Mediterranean was found in the Gulf of Algier, where at the outermost station, situated 3 miles from the coast, it was 120 g C/m^2 . For most parts of the Mediterranean coast, the annual rate of primary production is about 70 g C/m^2 . Although the production continues throughout the whole year, maximum and minimum periods are found at different seasons, due to the special conditions found.

No. 53
Fishes
(F)

Preliminary observations on *Ethmalosa fimbriata* (Bowdich)
fisheries in Senegalese waters and their biological aspects

by

T. Boely and
Centre d'Océanographie
de Thiaroye (O.R.S.T.O.M.)

J. Elwertowski
FAO/UNDP Special Fund
Project in Dakar

The authors present an analysis of "bonga" (*Ethmalosa fimbriata* Bowdich) fisheries in Senegal - estuary and coastal - and certain biological characters such as average number of vertebrae, average number of gill rakers, weight, sex ratio, which seem to indicate that the peninsula of Cape Verde constitutes a geographical and hydrological barrier for this species and that there are two distinct populations. These initial findings can only be considered as a preliminary basis for further research.

No. 54
General
faunistics
(F)

Aspects of faunistics in the North West African area

by

Cl. Maurin
Laboratoire de l'I.S.T.P.M., Sète (Hérault)

The author points out the importance of the area from the standpoint of faunistics and fishing resources. He describes surveys conducted in this area and reviews research work carried out on faunistics, biology of commercial species and on benthic ecology, mainly on the trawling grounds.

The paper concludes with a proposal for amending the present definition of the faunistic provinces and regions off North West Africa.

No. 55
Physical
oceanography
(F)

Hydrological observations on the Arguin
Bank Slope in December 1962

by

Ch. Allain
Institut Scientifique et Technique des Pêches Maritimes, Paris

During December 1962, in the course of a research cruise of the "Thalassa" to the Rio de Oro and Mauritania fishing grounds, four hydrological profiles were worked out, perpendicular to the continental slope between Cape Blanc and Cape Timiris.

T - S diagrams show that the water mass occupying the upper 300 meters has a

southern origin, since it is the result of a mixing of South Atlantic Central water and the Equatorial water from the Guinea area, while the underlying water mass, between 400 and 800 m, has characteristics of the North Atlantic Central water.

The upwelling occurring at the edge of the slope brings to the surface layer South Atlantic Central waters, which partly cover the shelf of the Arguin bank and tend to spread southward.

Comparisons are made with earlier studies and the conclusion is drawn that the Cape Blanc (Mauritania) latitudes constitute, at least in this season, a barrier in the hydrological system of the waters off North West Africa.

No. 56 The hydrographic conditions in the Atlantic waters
Physical off North West Africa
oceanography
(F) by

Ch. Allain
Institut Scientifique et Technique des Pêches Maritimes, Paris

Report on the work prior to the Symposium by the Chairman of the Section.

No. 57 Preliminary observations on Sardinella aurita (C. and V.)
Fishes in Senegalese waters
(F) by

T. Boely and C. Champagnat
Centre d'Océanographie, Thiaroye-Dakar
O.R.S.T.O.M.

Various characteristics of *Sardinella aurita* (C. and V.) have been studied along the Senegalese coast; head length/standard length relationship, number of gillrakers, vertebral counts, length-weight relationship, sex ratio, and stages of sexual maturity.

The comparison between samples from Dakar, Abidjan and Pointe Noire brings out a significant difference in the average number of gillrakers between these three localities and this characteristic might be useful to differentiate various populations along the West African shores. It might possibly reveal a different rhythm of growth for each population.

The vertebral mean of 47,554 shows no significant difference with that of Abidjan.

The changes in weight and condition factor K, allow us to put forward the influence of the environment upon adults, as seasonal changes in hydrological conditions seem to involve a decrease in weight.

Further studies are necessary to specify more accurately the various biological and hydrological factors influencing reproduction.

No. 58
General
faunistics
(F)

Contribution to the study of sediment cartography
of the Senegalese Shelf

by

J.P. Masse
O.R.S.T.O.M.

The sedimentological study of the present deposits on the Senegalese Shelf (region between Pointe des Almadies and M'Bour) allows for distinguishing six types of sediments. These types are distributed in more or less parallel zones.

No. 59
Crustacea and
mollusca
(F)

Note on the resources of *Penaeus duorarum* in Senegal

by

E. de Bondy
Centre d'Océanographie, Thiaroye-Dakar
O.R.S.T.O.M.

The exploitation of *Penaeus duorarum* in Senegal has already given good results. The fishery seems to be at an optimum level with the production of 500 tons per year in the area of the Casamance estuary but the resources existing at the mouths of the other rivers remain practically unexploited. At sea after 1966 it has become the principal resource of the trawl fishery which is approaching exportation figures of about 600 tons. It is very likely that an increase will be seen within the next few years.

No. 60
Statistics
and stock
assessment
(F)

Remarks on the fisheries statistics of West Africa

by

M. Delais
O.R.S.T.O.M., Paris

Remarks on the catch statistics presently collected at certain African ports and their breakdown by species.

No. 61
Crustacea and
mollusca
(E)

The feeding of the Western African coast shrimp
(*Penaeus duorarum* Burkenroad)

by

R.N. Burukovsky
Atlantic Research Institute of Marine Fisheries
and Oceanography (AtlantNIRO), Kaliningrad

The shrimp, *Penaeus duorarum* Burkenroad, is a predator and feeds on bottom organisms. The food consists basically of Malacostraca. Among these, amphipods and isopods occupy the first place and shrimps come secondly. As for other groups, molluscs, polychaetes, fish and cephalopods are of great importance as food organisms. There is a variability with age in the feeding habits of the shrimp, more mobile individuals being preyed upon as the shrimp becomes older.

No. 62
Fishes
(E)

Biology and distribution of the main commercial fishes,
and peculiarities of their fishing by trawl on the shelf
from Cape Spartel to Cape Verde

by

L. Domanevsky
Atlantic Research Institute of Marine Fisheries
and Oceanography (AtlantNIRO), Kaliningrad

In the area of North-West Africa the catches are mainly composed of horse mackerel (Trachurus trachurus, T. tricae), mackerel (Scomber colias) and Sparids (Dentex macrophthalmus and Dentex maroccanus).

Mackerel (Scomber colias) occurs in the catches taken in the area between 28°N and Cape Verde mainly at ages of 2-4 years. Spawning in the area of Cape Blanc takes place from December to February beyond the shelf, mature mackerels therefore being very scarce in the catches during this period. In the area of Saint Louis, spawning is observed from November/December to March. Seasonal migrations of mackerel are considerable; dense concentrations of the fish occur from October to February.

One of the horse mackerel (Trachurus trachurus) is among the most abundant species in the catches (up to 70%). The main fishing area for this species is located between 25°N and 19°N. Individuals of 20-35 cm in length, aged 4-5 years, are recorded in the catches. The spawning takes place from November to March at depths from 100 to 250 m.

The other species of horse mackerel Trachurus tricae has less commercial value. Dense concentrations of this species are found in the area between 22°N and 14°N. In the catches individuals of 22-45 cm predominate. Spawning can be observed from November to March at depths of 60-100 m. In contrast to the mackerel, the horse mackerel does not migrate over considerable distances. The main exploitation takes place between August and February.

As far as Sparids are concerned, Dentex macrophthalmus (60%) and Dentex maroccanus are the main species in the catches. They are found in the area between 34°N and 8°N at depths from 50 to 350 m.

The common length of Dentex macrophthalmus in the catches is 16-24 cm, and the main weight is 70-250 g. In the course of a year, the length-composition of the catches is not constant. Spawning of Dentex macrophthalmus takes place from October to April in deep waters at the edge of the shelf.

The common length of Dentex maroccanus is 14-19 cm and the weight reaches 50-140 g. Spawning of Dentex maroccanus can be observed from May to August at depths from 50 to 100 m. Compared with Dentex macrophthalmus, D. maroccanus is less of a deep-water species, spawning in summer. Optimal catches of Sparids are recorded during the periods August to September and December to February.

The stocks of the main commercial fishes in the area from Cape Spartel to Cape Verde are considered to be in a satisfactory state.

No. 63
Physical
oceanography
(E)

Geostrophic circulation of surface waters
on the shelf of North West Africa

by

A. Fedoseev
Atlantic Research Institute of Marine Fisheries
and Oceanography (AtlantNIRO), Kaliningrad

Research work on the dynamics of ocean currents and, in particular, the investigation of the horizontal water circulation has scientific as well as commercial significance. The purpose of this paper is to show seasonal patterns of geostrophic circulation at the surface by applying data averaged in a definite time and space scale, and based upon the dynamic method. As a result of this study charts of geostrophic circulation of surface waters on the shelf of North West Africa have been prepared taking into account the seasonal variability of the main dynamic formations of the area.

The Canary current is observed during the whole year. It is most intensive in winter. A number of quasi-stationary cyclonic eddies are being formed on the left (littoral) margin of the current, and the most developed whirl (to the south of Capé Blanc) exists during the whole year. Seasonal variability and influence of the Equatorial Countercurrent upon littoral waters are also considered.

No. 64
Fishes
(E)

Development and distribution of eggs and larvae
of *Trachurus trachurus* L.

by

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Atlantic Research Institute of Marine Fisheries
and Oceanography (AtlantNIRO), Kaliningrad

Eggs and larvae of the horse mackerel are described in this paper.

Since small developing eggs and larvae were found throughout the whole period of collection, i.e. from November to May, it seems that *Trachurus trachurus* breeds throughout the year.

Mass spawning of horse mackerel occurs in November in the region of Cape Blanc and Cape Barbas at water temperatures of 18.1 - 19.0° and in March in the region of Dakar in waters of 18.4 - 21° C.

The maximum quantity of larvae is found in these areas one month after the spawning peak.

The spawning grounds of horse mackerel coincide with the places where considerable concentrations of this species are recorded.

No. 65
Fishing and
utilization
of the catch
(E)

Fishing vessels, gear and methods at the North West coast of Africa

by

V.K. Savrasov
Atlantic Research Institute of Marine Fisheries
and Oceanography (AtlantNIRO), Kaliningrad

After a short review of the operations of Soviet fishing vessels in the shelf

waters of North West Africa, the author gives particulars of the following types of vessels:

BMRT	of the "Mayakovsky" type	(3,658 tons)
RTM	of the "Tropic" type	(3,325 tons)
SRT-M	of the "Mayak" type	(902 tons)

He also provides drawings and descriptions of different types of trawls (bottom-, midwater- and shrimp-trawls), used by those vessels, and describes the trawling technique used.

No. 66 Age and growth of Yellowfin tuna (*Thunnus albacares* Bonnaterre) of
Fishes the Atlantic Ocean

(E)

by

V.L. Zharov
Atlantic Research Institute of Marine Fisheries
and Oceanography (AtlantNIRO), Kaliningrad

The methods usually adopted for determination of age and calculation of growth rate of fishes are based either on the growth of hard tissues, such as scales, vertebrae or fin rays, or on measurements of the distance between scale sclerites. These methods are, however, not suitable for such purposes in the case of the Atlantic yellowfin tuna.

Examination of modal peaks within the yellowfin tuna length-range in the Eastern part of the Atlantic makes it possible, however, to establish that the fish reach a length of 51 cm by the end of the first year of life, 95 cm by the second year, 126 cm by the third year, and 152 cm by the end of the fourth year. When the tuna reach a length of 170-175 cm the growth rate slows down. The Atlantic yellowfin tuna have a high growth rate and a comparatively short life history, and do not in this respect differ from those of the Pacific Ocean.

No. 67	<u>Probabilities of the presence of Strombus bubonius</u>
Crustacea and	<u>off the coasts of Lanzarote and Fuerteventura</u>
mollusca	and of its absence off the Saharan coasts of Africa

(F)

by

F. Hernandez Pacheco
Instituto Español de Oceanografía and University of Madrid

The author presents a comparative study between the coasts of the islands of Lanzarote and Fuerteventura on the one hand, and those of the Sahara on the other. He notes the presence of Strombus bubonius and other temperate species in the Canaries and their absence from Saharan coastal waters.

This differential distribution is explained by differences in water temperatures between the respective areas; the waters are cooler off the African coast than off the Canaries, as a consequence of the existence, in the past, of a persistent wind regime, different from the present one, which used to cause warming and "down-welling" in Canary waters and, on the other hand, cooling due to up-welling off the African coast.

The paper is supplemented by a detailed survey of marine erosion and wind-borne

sedimentation, the latter having been at the origin of the raised beaches of today, formed during the quaternary period in both territories.

No. 68

Crustacea and
mollusca
(F)

Current data on the biology of the Palinurus species
on the Spanish Sahara Continental Shelf

by

G. Corral Estrafa
Instituto Español de Oceanografía
Laboratorio de Santa Cruz de Tenerife

Reference is made to the three species of the genus Palinurus to be found on the coasts of the Spanish Sahara, viz. Palinurus vulgaris Latr., Palinurus mauritanicus Gruvel and Panulirus regius Capello, the most abundant information being available on the first mentioned.

A general review is given of the geographic distribution of the genus. This is followed by considerations on the reproduction (sex ratio and sexual dimorphism; spawning; embryonic and larval development, growth of larvae etc.) of each of the three species.

Next studied are growth and the molting process, feeding, predators, migrations (large scale or merely local), behaviour and habitat. The report concludes with data on the geographic and bathymetric distribution of each of the three species.

No. 69

Crustacea and
mollusca
(F)

Sepia species off the Spanish Sahara coast

by

R.C. García Cabrera
Instituto Español de Oceanografía
Laboratorio de Santa Cruz de Tenerife

The biology of the species of the genus Sepia on the Canary-African fishing grounds is described.

Six species are listed (Sepia officinalis officinalis L., Sepia officinalis hierredda Rang, Sepia bertheloti d'Orbigny, Sepia elegans d'Orbigny, Sepia orbignyana Ferussac and Sepia elobyana Adam), the last-mentioned having been recognized solely by its internal shell found on the beaches of Cape Blanc and (one specimen only in very bad condition) among the stomach contents of a specimen of Muraena helena caught off the Canary Islands.

The most extensive and interesting part of the paper consists of a study of the biology of Sepia officinalis hierredda. Ninety-nine percent of the catches made by the freezer-trawler "Isla de Alegranza", during a survey (15 July to 2 August 1967) conducted by the Santa Cruz de Tenerife Laboratory, is accounted for by this species.

A description of fishing methods and nature of the fishing grounds is given, and the accompanying species are listed.

The spawning process in the case of Sepia officinalis hierredda is different from that of the other cephalopods, and "larvae" of this species have been kept alive on board for 24 hours.

Also recorded are biometric and biological data of the species listed above -

size, weight, weight-size ratio, sex, sexual maturity, etc., supplemented where *Sepia officinalis* hierreda is concerned, by a number of explanatory graphs.

No. 70	<u>Commercially significant Crustacea encountered</u>
<u>Crustacea and</u>	<u>between the Gulf of Cadiz and the Gulf of Guinea</u>

mollusca/
Fishing and
utilization
of the catch
(F)

by

M. Massuti Oliver
Instituto Español de Oceanografía.
Laboratorio de Palma de Mallorca

The paper describes the commercially important crustacea species caught on the continental shelf between the Gulf of Cadiz and the Gulf of Guinea.

Separate lists of species are given for the following areas:

Gulf of Cadiz;
Morocco;
Sahara, Mauritania and Senegal;
Gulf of Guinea.

In all cases information is given on the depths at which fishing is usually carried out and on the special localities where the major catches are obtained.

No. 71 Eastern-Central Atlantic: nominal catch statistics

Statistics (Also issued as FAO Fisheries Circular Nos. 178, 179 and 180)

and stock
assessment
(E/F) by

Current Statistics and Economic Data Section
Fishery Economics and Products Division
FAO Department of Fisheries

Fisheries Circular No. 178: Eastern-Central Atlantic nominal catch statistics: summaries, 1966

This Circular consists of three tables showing, for the years 1958 and 1961/66, the catch in the Eastern-Central Atlantic compared with world catch and catches in other regions; a breakdown by groups of species, and a breakdown by countries fishing in the Eastern-Central Atlantic.

Fisheries Circular No. 179: Eastern-Central Atlantic nominal catch statistics:
by countries, 1966

This Circular consists of 14 country tables, each showing catches and landings in the area, broken down by principal species arranged in groups for the years indicated in each table.

Fisheries Circular No. 180: Eastern-Central Atlantic nominal catch statistics:
by species, 1966

This Circular consists of one table covering the years 1958 and 1961-66, showing the nominal catch in this area broken down by groups of species and by principal species. For each species the total is broken down by countries fishing in the Eastern-Central Atlantic.

No. 72

All sections
(E/F)

The Council's activities
in its "Southern" area

by

H. Tambs-Lyche
Conseil International pour l'Exploration de la Mer
Charlottenlund

Report of the General Secretary of ICES on the activities of this international body in its southern area.

No. 73

(E)

Compiled abstracts of contributions available prior to the Symposium.

No. 74

Paper withdrawn.

No. 75

Fishing and
utilization
of the catch
(E)

Fisheries off Northwest-Africa

by

A.v. Brandt
Institut für Fangtechnik, Hamburg

The coast of Northwest Africa is an old fishing area for foreign trawlers with an increasing interest for countries of West-, East- and South Europe, also of the Far East recently. Nevertheless, only a small number of statistical data is available. Moreover, these data are sometimes arbitrary and contradictory. On the one hand a decreasing yield is mentioned, on the other the adjacent countries (Morocco, Rio de Oro, Mauritania and Senegal) plan a manifold increase of the national fishery. With the assistance of foreign countries and private interests new harbours will be built, new vessels be launched and also new processing plants are under discussion.

Of special interest are pelagic fishes for meal and canning, bottom fishes for meal and human consumption, Thunnidae deep frozen or canned, and also spiny lobsters for exportation either living or in form of frigerated tails.

In Morocco these resources are of high value to the economy of the country. The demand for fresh or dried fish is low in Morocco and Rio de Oro, on the other hand fish consumption is one of the highest in the world on the coasts of Mauritania and Senegal. In Mauritania, salted and dried fish, and in Senegal, fermented fish is preferred.

This situation caused the development of different types of fisheries. The traditional fisheries with small pirogues sometimes mechanized, using hand lines, longlines and small nets are concentrated in Senegal, a country which has a high fishermen's population. A semi-industrial coastal fishery with gillnets, lobster pots, purse seines and trawls and a national deep sea fishery with bottom trawls is under development. Fleets of foreign countries, including sailboats of the Canary Islands, can be based for months at the different places. These include freezer and factory trawlers, purse seiners with bait boats, pole-and-line boats for tuna, and Japanese tuna long liners.

The coasts off Northwest Africa, with a production of more than 1 million tons take an important place in world fishery. This does not apply only to foreigners engaged in Northwest African fisheries but also to the adjacent countries like Morocco with a high export of canned fishes to European and other countries or like Senegal with a high export of salted and dried fish to other parts of Africa. Therefore this area and some of these countries are linked up closely with the total economy of world fishing.

No. 76
Physical
oceanography
(F)

Contribution to the study of upwelling
in the African-Canarian region

by

D. Mascareño
Instituto Español
de Oceanografía
Laboratorio de
Santa Cruz de Tenerife

and

R. Molina
Instituto Español
de Oceanografía
Madrid

The authors present the results of two oceanographic cruises conducted by the Instituto Español de Oceanografía in collaboration with the hydrographic vessel "B.H. Tofiño" of the Spanish Navy, in August/September 1966 and March/April 1967.

The vertical and horizontal distributions of temperatures and salinities obtained during both cruises are compared and discussed. Upwelling taking place in the area of the Canary Islands also affects more southerly areas, as the emerging waters move on towards lower latitudes.

No. 77
Crustacea
and mollusca
(F)

A general view of crustaceans and molluscs

by

H. Vilela
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The author mentions the most common or economically important crustaceans and molluscs in the area of the African Atlantic continental shelf between the Straits of Gibraltar and Cape Verde.

Among the crustaceans he draws special attention to shrimps and prawns, spiny lobsters and similar species and among molluscs to cephalopods, giving some information on the fishery statistics for these species in the area. He examines the possibility of developing oyster farming.

In conclusion the author, pointing out the need for studies of the principal species with reference to their biology, conditions of their environment and fishing, recommends that such studies be made in collaboration with or according to a programme agreed on among the countries concerned.

No. 78
Fishes
(F)

Ichthyological problems of the continental shelf
of North West Africa

by

F. Lozano Cabo
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The substance of this paper is included in the report of the chairman of the Fish section.

No. 79
Physical
oceanography
(F)

Project for a physical study of the marine environment
in the North West African region

by

N. Menendez
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After analysing relevant facts known about the phenomenon of upwelling in this region, the author gives an outline of the possible approaches to the study of upwelling, where he includes: 1) preparation of synoptic maps of surface temperatures; 2) drawing up of vertical profiles of the thermo-haline structure and of the contents in phosphates, and 3) establishment of three hydrographic stations at the vertices of a triangle. The advantages and limitations of each of these approaches are discussed in relation to a possible future project to be undertaken by Spain.

No. 80
Fishing and
utilization
of the catch

Ghanaian long range trawlers catch on the Shelf
off Mauritania and Senegal in 1965/67

by

M. Zei and M. Ansa-Emmim
Fisheries Research Unit, Tema

Since 1964 Ghanaian long range trawlers have been fishing along the West African shelf north of Dakar, but no statistics of this fishery have so far been issued.

The authors give some tables of data on catch per boat, month and trip, which they were able to collect during the years from 1965 to 1967. The most common fish family recorded in the catches was the Carangidae, and although all mackerels were grouped under one unit, it became evident that the species of Trachurus and of Decapterus prevailed by far over Scomber colias. The next frequent group was the family Sparidae, with the prevailing Pagrus, and partly Dentex and Pagellus. Pomadasyidae, Psettodidae and other families were of much less economic importance.

Some fish were discarded as unprofitable. This mainly applied to undersized fish smaller than 3 to 10 cm, to sharks, rays and skates. Hake was also discarded as unsuitable fish for the home market. However sometimes the trawlers landed undersized fish of this species at Tema below some 10 cm. The best season seemed to be late autumn and early winter.

On average, hauls of 2-3 hours were made daily. Trawling was carried out only during daytime over a depth of 10 to 70 fathoms, on average between 20 and 40 fathoms, yielding mainly 5 to 10 tons per haul. The best hauls were over 50 tons. When the catch per haul dropped below 2 tons the trawler left the fishing ground and looked for

a better one. When catch per haul exceeded 30 tons any further trawling was stopped until the fish could be processed because of relatively low freezing capacity.

Main fishing grounds were between Dakar and Cape Blanc especially off St. Louis, in the so-called canyon (14 F Italian charts). Good catches were obtained off Cape Bojador and Arguin.

In conclusion one may say that better detailed catch statistics should be provided by the fishing vessels as to fishing unit, area, depth, species, fishing effort, etc. in order to give valuable information on the seasonal changes in distribution and abundance of economically most important species as well as for stock assessment studies.

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Firstly I wish to thank the Rector of the ancient University of La Laguna for his very friendly and kind expression of welcome to the International Council for the Exploration of the Sea and for the very fine facilities the University authorities have placed at our disposal for this important Symposium.

Before I left Dublin I read a guidebook to the Canaries in which these islands were said to have been described as the Blessed or Fortunate Islands, by ancient peoples. Now we all know that some guidebooks have a habit of exaggerating the claims of their subject but whether or not these islands were known to the ancients as the Blessed or Fortunate Islands we taking part in this Symposium are indeed both blessed and fortunate in both the facilities provided by nature and those provided by man. Never before has the Council had such admirable conditions in which to work and our grateful thanks go out to all those who have helped to bring about this sunny state of affairs.

In the name of the International Council for the Exploration of the Sea I bid all those taking part in this Symposium a hearty welcome. More especially do we welcome those representatives of countries not members of the Council and we hope that they will have both a fruitful and pleasant meeting. I hope to meet you individually some time during this Symposium.

An especial welcome must also be given to the scientists from the two research ships "Discovery" and "Thalassa". The name "Discovery" is an honoured one in the annals of oceanographic and polar research and "Thalassa", a more recent ship, has already added her name to the list of famous oceanographic research vessels.

The executive body of the Council is its Bureau consisting of seven persons. The importance which the Bureau attaches to this Symposium can be shown by the fact that no less than four members out of the seven are present here today.

The list of papers presented to this Symposium is an impressive one in keeping with this unique occasion because never before has the Council organized a meeting or Symposium outside the main continent of Europe. The Council was founded in the year 1902 and owed its existence to the initiative of a Scandinavian king, King Oscar II of Sweden and Norway who, in 1899, called a conference in Christiania, now Oslo, of Nordic countries to discuss what should be done to deal internationally with fisheries research. At first the Council was comprised of countries in the northern part of Europe but soon other countries further south - Spain, France and Portugal - became members. Since the great fisheries of Europe at that time were in the North Sea and its surrounding seas it is not surprising that the main emphasis was on the fisheries in the northern part of Europe. Gradually, however, more and more attention was paid to the area much further south. Although the major part of the Council's attention was devoted to the northern part of its area, some important work was done at a very early stage in the area in which we are meeting. Two papers by Mr H. Tambs-Lyche, our General Secretary, and Mr J. Smed will indicate the extent of these activities.

Since the last war important fisheries have developed along the coasts of Africa; fisheries which are important not alone to those countries which are pursuing them but must be of long term interest, as an important source of protein, to those coastal states which have hitherto not exploited these fisheries to any great extent. A number of Committees of the Council some time ago suggested that a Symposium should be held to ascertain what information was available as regards the living resources of the African Continental Shelf from the Straits of Gibraltar to Cape Verde, the hydrographic conditions thereon, what plans should be adopted to fill in the gaps in our

knowledge and what researches are desirable if we are to obtain the necessary information upon which to base regulations for the rational exploitation of the living resources of this area. The International Council for the Exploration of the Sea is a scientific body not restricted to any confined area. It is therefore well fitted to provide a forum for discussion of scientific programmes in relation to the subject matter of our present Symposium and the Council, through me, takes this opportunity to offer its fullest cooperation with any body or bodies which may be set up in relation to the living resources of this part of the African Atlantic Slope.

The Council is not the only body interested in these matters. Since the establishment of FAO after the last war the International Council for the Exploration of the Sea has had the closest cooperation with that body in the matter of collection of statistics, joint symposia, preparation of fisheries bibliographies and in many other ways. We in the Council welcome this cooperation with FAO and especially on this occasion. Our best thanks are due to those officials of FAO who have taken such an active part in the organizing of this Symposium. Dr Ruivo, on behalf of the Director-General of FAO, will be speaking to you shortly.

Before I close may I say how honoured I am to preside at this important Symposium held in such delightful surroundings. My wife and I would also like to thank our Spanish colleagues for the hospitality which we have received not only here in Tenerife but also on the Gran Canaria and the delightful island of La Palma. I will, of course, have the pleasant task of conveying the Council's thanks to all those who have contributed to the success of this meeting when I make my closing speech next Thursday. Let me say now a preliminary thanks to all of you.

After the Minister's speech, Dr Went said:

I wish to thank you Mr Minister for your very kind words of welcome to us on this occasion. We very much appreciate the organization which our Spanish friends have set up to make this Symposium a success. We convey, therefore, to you and the Spanish Government our grateful thanks for all that has been done for us so far. We all would wish to thank you for your hospitality last night when we had an opportunity of meeting together before the more formal part of our programme.

We were all very glad to hear of the developments in the fields of fisheries research oceanography to which you referred in your speech. We are aware how busy you are and may we express the hope for the success of the new Nautical School which we understand you are to open later this morning. The thanks of the International Council for the Exploration of the Sea are hereby tendered to you.

Address by Dr Mario Ruivo, FAO Representative

Your Excellency, Mr Rector, Mr President, Fellow Scientists and Colleagues:

It is both a very great honour and privilege as well as a pleasure to address the Symposium on behalf of the Director-General of FAO as well as on behalf of my colleagues in the Department of Fisheries. Mr Roy Jackson, FAO's Assistant Director-General (Fisheries) asked me in particular to inform you how deeply he regrets being unable to attend and participate in the Symposium. Other official duties have called him to participate in New York in the United Nations consultations concerning the future of research and the use of ocean resources.

The whole of this Symposium reflects the constantly increasing desire on the part of both ICES and FAO to continue to strengthen and expand the scope of the friendly collaboration that has been so firmly and successfully established in the fields of our common endeavour. In this regard, this Symposium will undoubtedly pave the way to further ICES/FAO activities including one next week.

I am thinking of the joint ACMRR/ICES Working Party on the Fishery Resources of the Eastern Central Atlantic and South East Atlantic. We hope that both these meetings, the very first of their kind in this area, would contribute to the evaluation of stocks and provide the scientific base for their rational exploitation. This is most urgent as there appear to be indications that these meetings would be able to advise on future research programmes including statistical, biological, environmental and related ones required to provide data needed for the formulation of management policies.

In all these waters of the Eastern Central Atlantic and of the South East Atlantic, there are growing problems of resource conservation requiring urgent national and international action as pointed out by the FAO Committee on Fisheries during its Second Session in Rome last year and the FAO Conference on the Fisheries of West African Countries (Dakar, 1967).

Because of the common property nature of these high seas resources, the problems relating to scientific investigations and the intergovernmental management of these fisheries resources have become the responsibility of all nations. This is regardless of whether they operate short distance or long distance fishing fleets, whether their craft includes highly industrialized fishing operations, or whether their operations are confined to those of subsistence fishermen only.

In order to provide intergovernmental machinery to assist all countries concerned with the fisheries of the region, FAO recently established a Fisheries Committee for the Eastern Central Atlantic, covering the waters lying between Gibraltar and the mouth of the Congo. Preparatory work is now under way to arrange for its First Session which, it is hoped, would be held during the first part of 1969 in a city located in West Africa.

With respect to the waters south of the Congo, a draft Convention on the living resources of the South East Atlantic has been prepared by the FAO secretariat. This is now being circulated to all interested countries for comment, in preparation for a conference of plenipotentiaries to be convened possibly in 1969. Both these actions would be complemented with respect to the tuna resources by the measures which undoubtedly would be taken by the proposed International Commission for the Conservation of Atlantic Tunas which would come into existence on the 7th ratification of the Convention prepared in Rio de Janeiro, May 1966.

Meanwhile, the FAO Expert Panel for the Facilitation of Tuna Research and its working parties are continuing to take steps to assist the task of the Commission once it is established.

It is generally recognized by all scientists concerned that one of the first steps in assessing fishery problems, establishing priorities in research programmes, etc., is to have access to internationally comparable data on catches by countries, by species, by fishing areas. These outputs have to be related to the physical inputs, reflected in the fishing operations, e.g. the fishing efforts, the gear. ICES, ICNAF and FAO have demonstrated very clearly what could be done to ensure inter-agency collaboration in the field of statistics. Our joint efforts, shown in the activities of the inter-agency Continuing Working Party on Fishery Statistics in the North Atlantic area, prove that the amount of data obtained could, through proper organization and collaboration by the intergovernmental agencies, be increased, with an actual decrease of workloads in the national offices. Our common experiences hitherto indicate that similar steps should be taken throughout the rest of the Atlantic.

The success of fishery research, resource management, fishery development in the Eastern Central Atlantic waters, as in all other fishing areas of the world, depends significantly on the effectiveness of regional fishery bodies. This effectiveness in turn is derived from the capacity of the collaborating countries to implement the jointly agreed regional programmes.

For example in the case of the Fishery Committee for the Eastern Central Atlantic many of the members have at this time fishery industries and administrative and research machinery at earlier stages of evolution. To enable these developing countries to participate more fully in these regional fisheries activities and to utilize more adequately the resources in the area, FAO is executing under the United Nations Development Programme a series of projects of about 11 million dollars in the maritime countries bordering on this region, e.g. the survey and development of pelagic fish resources. A shrimp survey is under consideration as a follow-up of the Guinean Trawling Survey, and preparation is being made in collaboration with the African Bank for Development.

In providing opportunities for the development of the fishing industry, FAO is paying attention to elimination of one of the most serious development barriers - lack of sufficient trained personnel at all levels. This battle is being fought through providing fellowships, arranging training centres, preparing manuals. Here for example, ICES is organizing with FAO's assistance a training course on acoustic methods for fish detection to which we hope to send participants from West Africa.

This tremendous task is one for which we have to marshal all the resources available to us - bilateral and multilateral. Many developed countries have for years devoted their attentions to these questions, and others are joining in the common task of providing aid or in cooperation with the UN, FAO and UNESCO and regional organizations like the Organization of African Unity (OAU) and the International Council for the Exploration of the Sea. The implementation of the far-reaching UN Resolution on Resources of the Sea would provide a framework for well-coordinated programmes and actions in the field of training and education of scientists, technicians and fisheries personnel.

On the execution of these single and multi-country projects we are very fortunate to enjoy close collaboration with many scientists from ICES member countries. They serve for various periods of time as experts, consultants, and in other capacities. There is also close collaboration with organizations executing research and survey projects in the region, e.g. ORSTOM. We recognize that this represents a heavy demand on many laboratories and research institutions of developed countries, but such a contribution towards the fostering of research in areas like West Africa should be considered as a form of international assistance.

Simultaneously with the activities I mentioned before, FAO is promoting studies on the relationship between the resources and their environment. In this regard particular mention should be made of the successful results achieved by the International Cooperative Investigations of the Tropical Atlantic (ICITA) undertaken by the Intergovernmental Oceanographic Commission under UNESCO. This would lead us to the conclusion that in the same way, the systematic study of the oceanography and productivity of the waters of the northern part of the Eastern Central Atlantic (Gibraltar to Dakar) should be subjected to an intensified study in the not too distant future. Such a study would contribute significantly to a better understanding of the dynamics of the resources in these waters. This was recognized at the time of the UNESCO/FAO/OAU Symposium on the Oceanography and Fishery Resources of the Eastern Atlantic (Abidjan, 1966), and FAO intends to request the Advisory Committee on Marine Resources Research (ACMRR) to review this problem taking into account also the conclusions of this Symposium. This may lead to action by IOC in cooperation with other international bodies concerned.

I must apologize for this somewhat lengthy enumeration, but addressing such an important gathering of specialists from so many nations, I felt it advisable to touch on some of the points reflecting the ramification of the background to our common problems, some of them to be considered by this Symposium and the joint Working Party.

Your Excellency, may I express on behalf of FAO's Director-General and in particular of the Department of Fisheries, our deepest appreciation for your kindness in inviting us, together with ICES, here in these beautiful islands, so appropriately located for the purpose of this Symposium.

We are particularly grateful for organizational arrangements undertaken by our Spanish colleagues from the Instituto Espanol de Oceanografia.

The Rector of the University of La Laguna deserves our thanks for providing these excellent premises.

Mr President, both on behalf of FAO and on behalf of myself and my colleagues present here, I come to express once more our gratification at another important link in our close and already traditional collaboration and common endeavour.

On behalf of the Director-General I wish you all success in the deliberations of the Symposium.

